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ABSTRACT

This set of activities is designed to bring water resource education into the middle school classroom using an interdisciplinary approach. The packet contains timely, localized information about the water resources of west central Florida. Each activity is aligned to middle-school Sunshine State Standards. These hands-on, minds-on activities can be used alone or together as a ready-made team project. Each activity includes introductory information, learning goals, subject disciplines covered, and standards met along with necessary materials and activity descriptions. Many also have activity extensions. Students design a new Florida town that balances economic and environmental consequences, build models of wetlands and the hydrologic cycle, write stories tracing the journey of a water drop through the hydrologic cycle, and design landscapes using drought-tolerant plants and principles. A special packet of fact sheets on Florida's endangered species and their wetland habitat includes a memory game. Other activities address water needed for growing food, home water use, water preservation in Florida, and desalination plants. Individual fact sheets offer water-conservation tips and discuss the history of Florida wetlands. Addresses on the World Wide Web that provide water data, educational activities, and links to additional water Web sites are also included. (PVD)

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Splash!

Water resource educatio

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Fine Arts

Social Science

Mathematics

Science

Language Arts

Refreshing Your Middle School Classroom With a Diversity of Disciplines

SE 060 035

What are you waiting for? Jump right in and make a

It's multi-disciplinary!

It's educational!

It's in this packet!

And it's for you!

ater Resource Education = Water Resource Appreciation

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Dear Educator:

Welcome to the world of *Splash!*

You hold in your hands a unique set of activities designed to bring water resource education into your classroom. Whether you teach middle-school English, math, social studies, geography, science, or art, *Splash!* is for you.

The Southwest Florida Water Management District offers *Splash!* to help teachers engage middle school students in the protection of our precious water resources.

Splash! is

- **refreshing:** *Splash!* activities are fun, effective and easy to use.
- **multi-disciplinary:** Use any activity alone or use the packet as a ready-made team project. The color bars at the top of each activity page indicate the related disciplines.
- **relevant:** *Splash!* contains timely, localized information about the water resources of west central Florida.
- **minds-on/hands-on:** *Splash!* will engage your students in lively discussion and meaningful activity.
- **designed for you:** Each activity is aligned to middle-school Sunshine State Standards.

Many other free education materials are available from the Southwest Florida Water Management District. To receive them, mail or fax your order to us on the form included in this packet. In addition, excellent curricula such as *Who Gets the Water?*, *Water From the Ground Up*, *Water Watcher*, and *Project WET* are available through free Water Resources Workshops. If you are interested in learning more about a teacher training workshop in your area, fill out and return the Water Resources Workshop form.

We invite you to try one or all of the activities in this packet. Feel free to make as many copies as you want and share them with other teachers – the materials are not copyrighted. After using the activities in your classroom, please fill out and return the *Splash!* evaluation form. Your comments and suggestions will make *Splash!* even more useful to the teachers and students in west central Florida of the future.

Splash! was designed with today's teachers and students in mind, so take the plunge into water resource education today. Make a splash in your classroom — and a difference in your world.

Sincerely,

Beth Bartos

Beth Bartos
In-School Education Coordinator
Southwest Florida Water Management District

Southwest Florida Water Management District

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The Southwest Florida Water Management District is the agency responsible for managing your water resources. Its job is to maintain a balance between the water needs of current and future water users without damaging the environment.

The District serves 3.7 million people in a 10,000-square-mile area that covers all or part of these 16 west central Florida counties: Charlotte, Citrus, DeSoto, Hardee, Hernando, Highlands, Hillsborough, Lake, Levy, Manatee, Marion, Pasco, Pinellas, Polk, Sarasota and Sumter.

The District is governed by an 11-member board of volunteers appointed by the Governor and confirmed by the Florida Senate for a four-year term. Additionally, there are eight Basin Boards representing surface water basins within the 16-county area. The 43 volunteers serving on the Basin Boards also are appointed by the Governor with approval of the Florida Senate. They advise the Governing Board on local matters and provide a funding source, in cooperation with local governments, for projects with local impact.

Water Supply

A variety of effective water supply programs, including a Water Use Permitting program, regulate the amount of water taken in the public interest from underground sources. The District's regulatory efforts are balanced with incentives such as the New Water Sources Initiative and other cooperative funding projects to encourage the development and use of recycled water, aquifer storage and recovery, and other non-traditional sources.

Water Quality

Regulatory programs, such as Well Construction and Water Use Permitting, prevent overuse and contamination of groundwater supplies. A Quality Water Improvement Program helps plug abandoned wells to keep pollution from reaching underground sources through surface openings. The Surface Water Improvement and Management (SWIM) program helps communities improve the quality of surface water and restore plant and animal habitat.

Flood Protection

The District operates 74 water management structures. Some of them are operated in times of flood to divert water away from people. Others are used in times of drought to keep lake levels up. Others serve as barriers to keep salt water from entering fresh surface waters.

Natural Systems

In the public interest, the District acquires land to protect the natural systems that sustain our water resources. Ninety-nine percent of the lands acquired for this purpose are available for passive recreation such as camping, fishing, biking and hiking. The District is now caretaker to nearly 250,000 acres of protected public land. A booklet, "Recreational Guide to District Lands", is available on request.

Southwest Florida Water Management District In-School Education Programs

- ✔ educate students about their local water resources.
- ✔ coordinate and encourage partnerships with other agencies and organizations.
- ✔ provide students hands-on experiences with nature.
- ✔ establish a sense of stewardship for local water resources.
- ✔ provide materials and opportunities for students to include their families in water resource education.

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Water-Saving Tips

15 Simple and Fun Ways to Save Water

1. When you brush your teeth or wash your face, keep the water in its place! By turning the water off when doing these things, you can save 10 gallons a day.

2. Short showers keep you fresh for hours! A 10 minute shower easily can be cut in half — and you'll get just as clean. In the shower, you use 5 gallons of water per minute. Cutting your shower time in half can save 25 gallons per shower or nearly 10,000 gallons a year.

3. Why rush to flush? Some toilets use as many as 5 gallons per flush. Tissues, insects and the like belong in the trash, not the toilet.

4. Splish-splash when you fill up the bath! Filling the bath uses between 40 and 60 gallons of water. If you fill up the bath only half way, you can save water — and you could use less than if you had taken a shower.

6. A bottle in the tank is water in the bank! If you have a standard-model toilet, you can place a filled and capped plastic water bottle inside the tank. You will flush less water this way and save thousands of gallons a year. (Sometimes people place bricks inside their toilet tank. Bricks can corrode and damage your plumbing.)

5. Go with the low flow! You can save even more water in the shower by replacing a standard shower head with a low-flow version. Your family can find one for roughly $6, and they are easy to install. A new shower head can save your family 30 gallons a day.

Also, most toilets use more water than they need. If your family installs a low-flow toilet, you can save 2 gallons a flush. A low-flow toilet can save you and your family more than 10,000 gallons a year.

7. Another tip: fix a drip. If you notice a leaky faucet or toilet, tell your folks about it. At two drips per second, your family can lose 400 gallons a month.

A survey has shown that 1-in-5 toilets leak. An easy way to tell is to drop some food coloring into the toilet tank. Check a half hour later for the color to appear in the toilet bowl. If it does, then you have a leak. (Flush as soon as the test is done since food coloring may stain the tank.)

Repairing leaks is an easy, inexpensive way to save your family thousands of gallons of water every year.

8. Saving water doing dishes leaves some water for the fishes! When washing dishes by hand, let dirty dishes soak in soapy, hot water. Rinse them quickly under a slow stream from the faucet.

9. Take a load off your mind! Run only full loads in the washing machine or dishwasher. Washing machines use an average of 43 gallons a load, and the fewer loads you run, the more water you save. A full dishwasher will save water over washing dishes by hand. Running the machines when they're full will save you time, energy — and water.

10. Rather than play with a water toy, find something else you enjoy! Avoid playing with outdoor water toys that require a constant stream of water to work. These toys can use between 150 and 300 gallons every half hour. Find other fun outdoor activities that don't require you to leave the water running.

Water-Saving Tips

11. When it's hotter, you'll lose more water. Water the lawn only early in the morning or after the sun sets on your authorized days. This will keep the water from quickly evaporating in the sun. When watering, avoid using a fine spray because much of the water will be lost in the wind or to evaporation.

12. If the grass isn't tall, why mow at all? The taller grass is, the less water it needs. When mowing, raise the mower blade to its highest level. A higher cut encourages grass roots to grow deeper, creates shade that cools the roots and holds soil moisture better than a closely trimmed lawn.

13. Watering rarely is watering fairly! Lawns need watering once every five to seven days during summer and every 10 to 14 days during winter. Good soakings are better for your lawn than frequent short sprinklings. A hearty rainfall will keep your lawn moist for the next several days.

14. Wash the car with elbow grease, and wasting water will decrease! When washing the car, use a bucket, rag and a hose with a shut-off nozzle. Washing your car by spraying it clean can use as much as 100 gallons. You can get your car just as clean and cut water use to 15 gallons if you use the hose only to wet down and rinse it off, doing the rest of the washing by hand.

15. Wash the car in the shade, and water lost will now be saved! Washing your car in the shade will keep the water you use from evaporating as quickly. Use biodegradable soap (soap that doesn't harm the environment), and wash the car so that the extra water flows onto a lawn or plant bed. Grass, plants and trees could use the extra water much more than your driveway or sidewalk.

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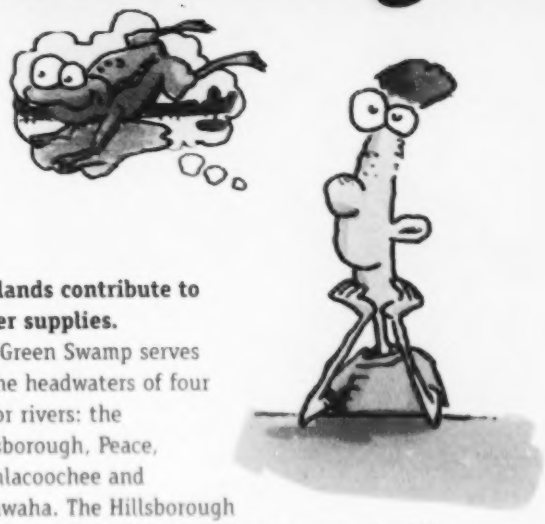
A Wetland For Your Thoughts



Protecting Wetlands is a State of Mind

As settlers journeyed through the young United States, they built roads, farms, factories, cities, etc.

Swamps, marshes and other wetlands were often seen as worthless, standing in the way of progress. As America grew, wetlands were destroyed. California has lost more than 90 percent of its wetlands. Today there are 99 million acres of wetlands remaining in the lower-48 states. More than 10 percent of those remaining wetlands are in Florida.

In the 1800s, wetlands covered more than half of Florida. The state has lost nearly half of its wetlands since pioneer times. Wetlands today cover 30 percent of Florida.

Today attitudes regarding wetlands have come full circle. What were seen as wastelands as recently as 30 years ago are now regarded as an invaluable resource to our quality of life.

The **Southwest Florida Water Management District** promotes the preservation of wetlands. The SWFWMD regulates the human activities and development that take place in wetlands covering all or part of 16 west central Florida counties. The SWFWMD also acquires sensitive tracts of wetlands, such as the Green Swamp, through state programs such as Save Our Rivers and Preservation 2000. The aim of these acquisitions is to protect the land for the water's sake.

Wetlands provide protection from flood and storm damage.
Wetlands temporarily store flood waters, protecting property owners downstream from severe flooding. They also slow floodwaters, lowering wave heights and reducing soil erosion. Researchers at the University of Florida discovered that when wetlands make up as little as 10 percent of the landscape, flooding decreases by 60 percent. When wetlands cover 20 percent of an area, flooding decreases by 90 percent.

Wetlands contribute to water supplies.
The Green Swamp serves as the headwaters of four major rivers: the Hillsborough, Peace, Withlacoochee and Oklawaha. The Hillsborough and Peace Rivers are significant sources of public-supply drinking water. According to the Southwest Florida Water Management District's *Guide to Recreational Lands*, the area is extremely important for groundwater recharge as the aquifers are near the land surface. Groundwater aquifers are another significant source of water for dirnking and other uses in West Central Florida.

Wetlands may affect climate.
It is speculated that by creating updrafts, wetlands in the Everglades trigger the summer rains vital to the water cycle of south Florida. Wetlands may also help moderate temperature extremes by slowly releasing heat on the coldest winter days and by cooling the air during the summer.

Wetlands provide nursery areas, nesting habitat, wintering habitat, and feeding grounds for fish and wildlife.
Spectacular wading birds including herons, egrets, ibises, spoonbills, and storks feed and nest in wetlands. In fact, nearly 20 percent of the Atlantic coast's wintering waterfowl (between 700,000 and 1.2 million birds) depend on Florida's wetlands. Wetlands support nearly three-quarters of the birds considered endangered in the state. Large mammals, such as white-tailed deer, bobcats, grey foxes, black bears, and panthers, use wetlands for denning sites, movement corridors, escape cover and food. The largest reptiles in the United States, the American alligator and the endangered American crocodile, live in Florida's wetlands.

Source: U.S. Fish and Wildlife Service

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Water On The Web

Gettin' Wet on the Net

Water resource education has made a splash on the Internet. Information that would have taken hours to gather in a library is now available within minutes over the World Wide Web. Below is a list of Web addresses that provide water data, educational activities and links to even more water Web sites.

Southwest Florida Water Management District
http://www.dep.state.fl.us/swfwmd/menu.html
The site maintained by the Southwest Florida Water Management District provides a broad range of water-related information specific to west central Florida. Areas of interest include the *Water Web* newsletter, District maps, recreational lands, Xeriscape information, issue papers, etc.

Educating Young People About Water
http://www.uwex.edu/erc/ywc
An excellent resource for teachers wishing to expand their library and see what others are doing in water education, this Web site provides links to new water-themed curricula from all over the country, reviews and order information for 100 water resource curricula.

USGS Water Resources of the United States
http://www.usgs.gov
The U.S. Geological Survey Web site provides access to water statistics and historical data, as well as much information about national water use. The site also provides information for ordering several water-related cartoon posters designed for students K-12.

The Environmental Protection Agency
http://www.epa.gov/kids
The EPA provides a kids' page chock full of activities that relate to drinking water and water quality. The latest water news and the most recent of the EPA's reports are also featured here.

Surf Your Watershed
http://www.epa.gov/surf
The EPA also provides this service to help people locate, use and share environmental information about their watershed or community.

National Wetlands Inventory
http://www.nwi.fws.gov
This Web site maintained by the U.S. Fish and Wildlife Service provides information about wetlands including data, status, ecology and a special section for educators. Also included is a Geographic Information System (GIS) view of the country's wetland inventory.

Water Wiser
http://www.waterwiser.org
This site provides links to several water-efficiency and conservation Web sites.

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Give Shape to a Xeriscape™

Keep up With the Joneses

The Jones family has moved into a house near your school. They think their yard is bland. What they would like is to have an interesting yard that saves water and doesn't require too much maintenance. In this activity, your class will play the role of landscape architects working with the Joneses. As a group, you analyze the site and come to the same conclusion: Xeriscape!

Xeriscape combines the Greek word *xeric* (meaning dry) with the word *landscape* to form a term for a planted area that doesn't need much water.

People can save water using principles of Xeriscape in their yards. Lawns and most flowers require much water to grow. Between 25 and 50 percent of the water people use goes toward their yard. Using principles of Xeriscape in a yard can help save water and keep a yard looking beautiful even during times of drought.

Learning goals

- To practice problem solving
- To learn about plants and basic landscape architecture
- To draw plants and landscapes

Subjects

- Fine Arts
- Science

Materials

- pencils and erasers
- color pencils and pens

Sunshine State Standards

Fine Arts/Visual Arts: Creation and Communication, VA.B.1.3; Applications of Life, VA.E.1.3.
Science: Processes of Life, SC.F.1.3; How Living Things Interact with Their Environment, SC.G.1.3; The Nature of Science, SC.H.1.3

Activity

Provide students with photocopies of pages numbered 1 through 7 of this activity. Have the students follow the directions on Page 1 which will instruct them on how to create a Xeriscape. Let students use the teacher's copy to see the plants' colors. When the students are finished, let them share their landscape designs to the class, explaining the thinking behind their designs.

Extension

Bring in a houseplant to serve as a model for student drawings. Ask the students to draw the plant and capture the plant's character in their drawings.

Xeriscape: Saving Water with a Plant-Friendly Yard

1 Play the role of a landscape architect. Landscape architects design yards for homes and plantbeds for businesses. When creating a landscape design, a landscape architect must consider what the client wants and what the plants need based on factors such as climate, sun, water availability, etc. In this activity, the Jones family wants you to design a landscape for their home.

They have requested:

- To save water
- To do less maintenance
- To bring in some birds
- To grow more trees
- To keep some lawn area for barbecues and volleyball
- To keep from feeling closed in by too many trees and shrubs

You have decided a Xeriscape is the kind of design to give their home

2 First, become familiar with the seven guidelines to Xeriscape on Page 6. Trace the layout of the house and yard provided to you. Using the examples from the plant list, draw the plants onto the layout of the Joneses' home. To see the appropriate colors of the plants, ask to see the teacher's manual or check out Florida plant books from the library.

- Consider factors such as sun and shade.
- Try grouping the plants that need the most water together so that it will be easy for the Joneses to water them.
- Keep in mind how tall each of the plants will grow and how much room the plants will take once they are established.
- A Xeriscape is not only about plants. Pathways and play areas can also be covered with mulch or wood chips.

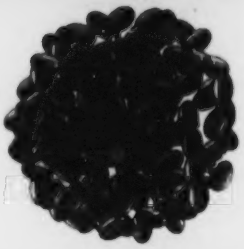
3 When you have completed your landscape design, the Jones family will want you to explain your ideas to them, so they can imagine what their yard will look like once it has been planted. Prepare to give the family a report.

PLANT LIST

See Page 5 for additional Plant List

Vine

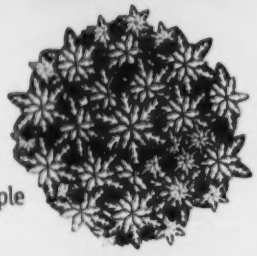
Coral Honeysuckle
Lonicera sempervirens



- sun to partial shade ○ – ◐
- drought tolerant
- red flowers

Flower/Ground Cover

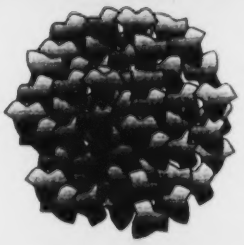
Impatiens
Impatiens spp.



- to 1' tall
- partial shade to full shade ◐ – ●
- oasis
- white, red, pink, purple and orange flowers

Vine/Ground Cover

English Ivy
Hedera helix



- partial shade to shade ◐ – ●
- drought tolerant

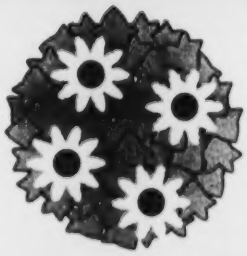
Flower/Ground Cover

Bromeliad
Vriesea spp.

- to 2' tall
- partial sun to shade ◐ – ●
- drought tolerant
- orange or red flowers

Flower/Ground Cover

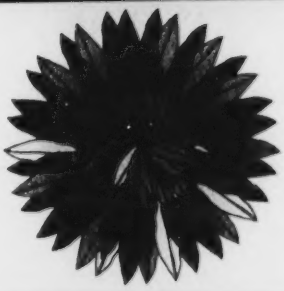
Beach Sunflower
Helianthus debliis



- to 1' tall
- sun ○
- natural

Ground Cover/Shrub

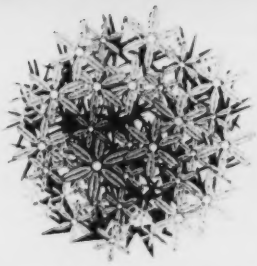
Cast-Iron Plant
Aspidistra elatior



- to 2' tall
- partial sun to shade ◐ – ●
- natural

Flower/Ground Cover

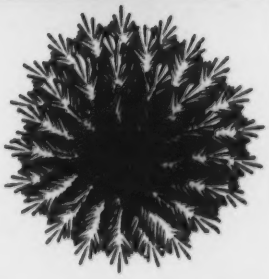
Blue-eyed Grass
Sisyrinchium spp.



- to 1' tall
- sun to partial shade ○ – ◐
- oasis
- blue flowers
- native

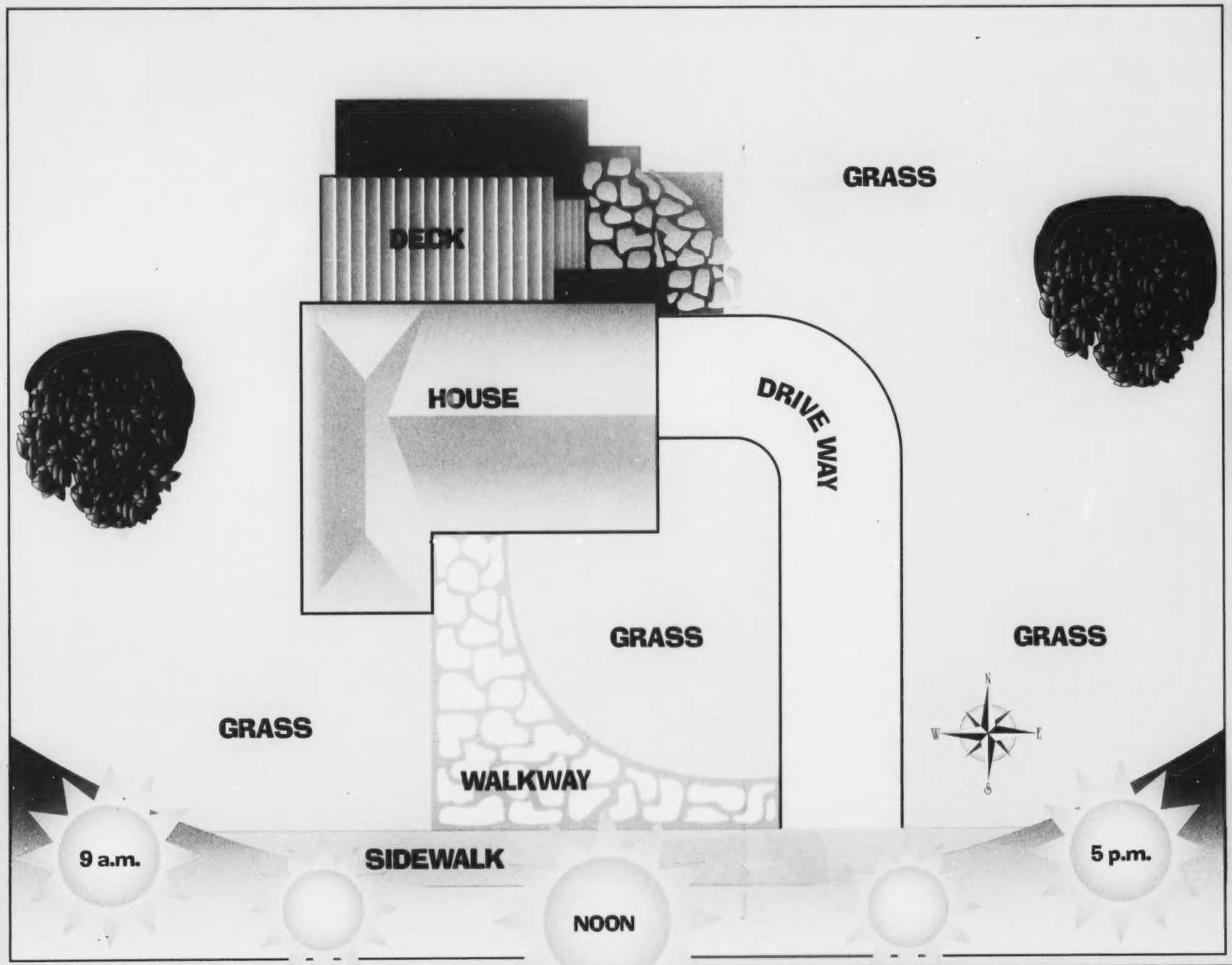
Ground Cover/Shrub

Coontie
Zamia pumilia



- to 3' tall
- sun to shade ○ – ●
- natural
- native

Give Shape to a Xeriscape



KEY

○ = **Full Sun**

◐ = **Partial Sun and Partial Shade**

● = **Shade**

Native: plant species that have made west central Florida home for thousands of years

Habitat value: creates food or nesting/ foraging habitat for birds and wildlife

Oasis: much watering needed

Drought tolerant: little watering needed

Natural: should be able to survive on rainfall alone

See Back Page For an Example of a Completed Xeriscape Design

TIPS

- If you are creating pathways and play areas covered with mulch, it might be easier to design those first and then place plants around them.
- Remember to group plants with similar water needs together.
- Keep in mind the position of the sun and where the shady areas are. If you plant tall trees, you will create shade on the north side of them.
- "Layer" the Xeriscape so that the smallest plants are closest to the home and that the tallest trees are farthest away.

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PLANT LIST

See Page 2 for additional Plant List

Ground Cover/Shrub

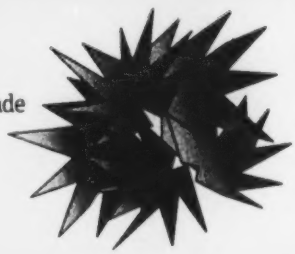
Juniper
Juniperus chinensis
- to 8′ tall
- sun ○
- natural

Tree

Weeping Willow
Salix babylonica
- to 40′ tall
- sun ○
- oasis

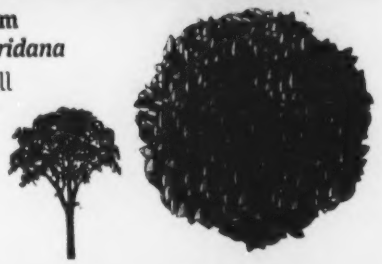
Shrub

Saw Palmetto
Serenoa repens
- to 8′ tall
- sun to partial shade ○ – ◐
- natural
- native
- habitat value



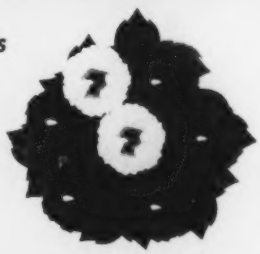
Tree

Florida Elm
Ulmus floridana
- to 60′ tall
- sun ○
- natural
- native



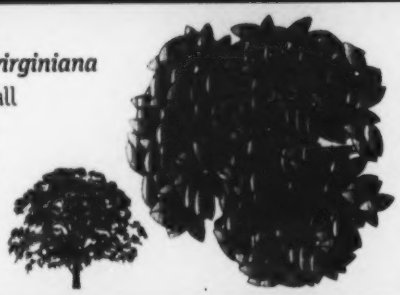
Ground Cover/Shrub

Hibiscus
Hibiscus rosa-sinensis
- to 10′ tall
- sun ○
- oasis
- red, yellow and orange flowers



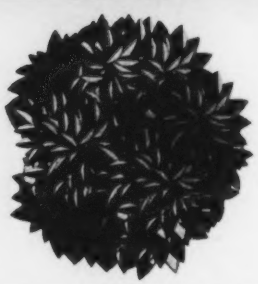
Tree

Live Oak
Quercus virginiana
- to 80′ tall
- sun ○
- natural
- native
- habitat value



Shrub

Wax Myrtle
Myrica cerifera
- to 20′ tall
- sun to shade ○ – ◐
- natural
- native
- habitat value



Tree

Cabbage Palm
Sabal palmetto
- to 60′ tall
- sun to partial shade ○ – ◐
- natural
- native
- white flowers

These are the seven guidelines people use when creating a Xeriscape. Becoming familiar with them will help you make your design.

1 Designing a Xeriscape

Determine which areas of the yard are wet or dry, shady or sunny.

2 Arranging the plants

When you place plants in your design, make sure you are giving them an appropriate home to grow. Group together plants that need the same amount of sun, shade and water together. "Layer" the Xeriscape so that the smallest plants are closest to the home and the tallest trees are farthest away.

3 Improving the soil

Florida soil is sandy, so water seeps through it quickly. Mix organic matter, such as homemade compost, peat, manure or topsoil into your flower or vegetable gardens to improve the soil's ability to hold water.

4 Practical turf areas

Turf grass can require more water and maintenance than any other part of the landscape. Always look for drought-tolerant varieties when installing new turf areas.

5 Water wisely

By grouping plants according to their water needs, you can water more efficiently. If you group all the "oasis" plants near each other, it will be easier for you to water them when they need it. It may be the only section of your yard that you ever need to water.

6 Use mulches

Pathways and play areas covered by 2 to 3 inches of mulch or wood chips will reduce weeds and slow erosion. Mulched areas never need water!

7 Proper maintenance

Keep the yard trimmed, mowed and weed-free. Usually it takes less effort, money, and water to maintain a Xeriscape garden than a traditional yard.

A Common Sense Approach to Lawns

Lawns and fun go together. Lawns have countless uses — including barbecues and picnics, volleyball and frisbee. The downsides of a lawn include mowing, fertilizing, and watering.

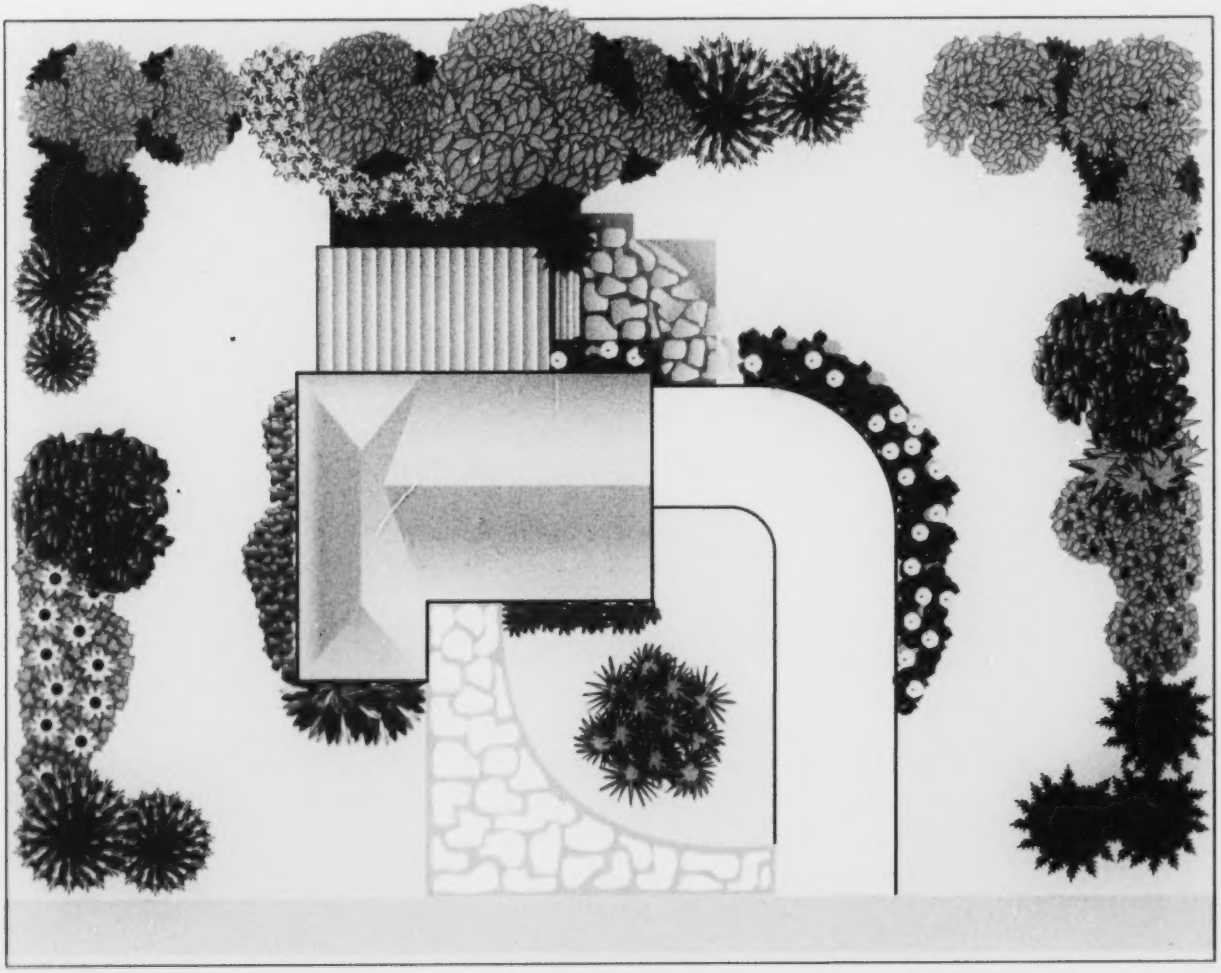
Today, with concern for the environment increasing, many people are looking closely at their yards and turning to principles of Xeriscape to make their yards more Earth-friendly. The Southwest Florida Water Management District provides a *Plant Guide* featuring a number of trees and shrubs that people can plant in otherwise unused lawn space. These trees and shrubs can beautify a yard, attract birds and wildlife and help the environment in many other ways.

For example, less lawn means less mowing — and less mowing with gas-powered mowers means better air quality in the neighborhood. Many of the plants and shrubs listed in the *Plant Guide* also require less fertilizer than lawns. Less fertilizer means better water quality in nearby streams and rivers, and that means healthier fish. Lastly, since many of the plants in a Xeriscape can survive on rainfall alone, less lawn means using less water — and using less water in the yard helps preserve local water resources.

Nothing beats the fun a lawn provides a home. But in applying principles of Xeriscape to unneeded lawn areas, a home can have a "lawn" of fun and protect the environment, too.

For additional information about water-saving yard practices or to learn the locations of various Xeriscape demonstration sites throughout west central Florida, contact the Southwest Florida Water Management District at (352) 796-7211 or in Florida at 1-800-423-1476, extension 4757.

Example of a Completed Xeriscape Design



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Splash
Water resource education

Hydro-Cycle Works

What Goes 'Round Comes 'Round

Water is always on the move. It falls from the sky as rain, hammers the coastline as waves, trickles through crevices 1,000 feet underground, vaporizes and sails slowly into the clouds. Even water buried under thousands of pounds of ice in the polar icecaps is on the move — its movement is slow, sometimes taking thousands of years to budge even a few inches.

Water moves continuously through a natural system called the hydrologic cycle. Powered by the heat of the sun, all the water that falls to the ground as precipitation sooner or later makes its way back into the clouds where it eventually becomes precipitation again.

The saying goes, "what goes around comes around." In the case of water, that is certainly true.

Because all of the planet's water circulates through the hydrologic cycle, Earth is a closed system. In effect, the same water is here as was here when Earth was formed.

In this activity, your students will build themselves a model of the hydrologic cycle out of two-liter soda bottles and see for themselves the process Earth uses to recycle its water supply.

Learning Goal
To use household items to build a model of the hydrologic cycle.

Subject
Science

Sunshine State Standards
Science: Processes that Shape the Earth, SC.D.1.3, SC.D.2.3; How Living Things Interact with Their Environment, SC.G.1.3

Materials
- three empty plastic 2-liter soda bottles
- three plastic bottle caps
- two feet of heavy cotton string (wick)
- hair dryer
- soil
- water
- ice
- tape
- plant seeds (Chinese cabbage, turnip, etc.)
- food coloring
- tools for converting the bottles into the model: wax pencil, scissors, an instrument to poke holes in the tops of the plastic bottle caps, razor in a safety holder

Activity
1. Have the students gather the materials and tools they will need.

2. Use a hair dryer on the lowest heat setting to soften the glue on the soda bottle labels so that you may remove them. Mark the bottles A, B and C to tell them apart. Cut each bottle as shown in diagram on the back of this sheet.

3. Poke a hole in the bottle cap on B. Insert a string/wick loop so that roughly 3 inches hang down from the cap. Place a cap with no hole on C. Tie roughly seven inches of string around the neck of C, so that it hangs down about 3 inches. See diagram for examples.

4. Assemble bottles as in diagram: C fits into B, and B fits into A. Thoroughly wet both wicks. This will bring a constant source of water from a reservoir to the plant roots. Add roughly a pint (16 oz.) of water to A. This reservoir supplies water to the model's cycle. Fill B with enough pre-moistened soil to cover the top of the string loop. The string should not be pressed against the side of the bottle.

Hydro-Cycle Works

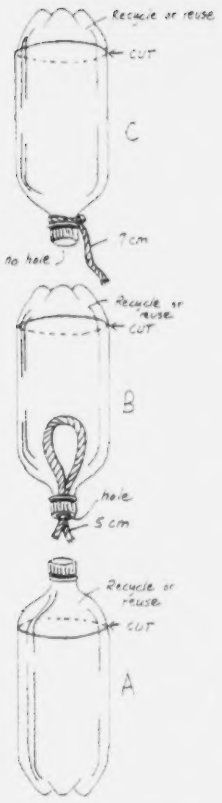
Activity (cont.)

5. Plant two or three seeds of a fast-growing plant, such as Chinese cabbage or turnip, in soil inside the well of B. (Remove C from the other bottles when not performing a demonstration, so that air circulates, and the seeds can sprout and grow.)

6. Place a plastic bottle cap on top of the soil in center of B, so that the wick from C drops into it. The bottle cap represents a water body and will collect water when the model "rains."

7. Fill Bottle C with ice water. Tape the seams between bottles to seal them. Observe the bottle cap after a few hours. The model's condensation should have filled the cap with water.

8. Repeat the experiment, but his time add a drop of food coloring to the bottle cap before you begin. When "rain" fills the cap, the food coloring will have tainted the water. Explain that this is how pollution can contaminate water bodies.

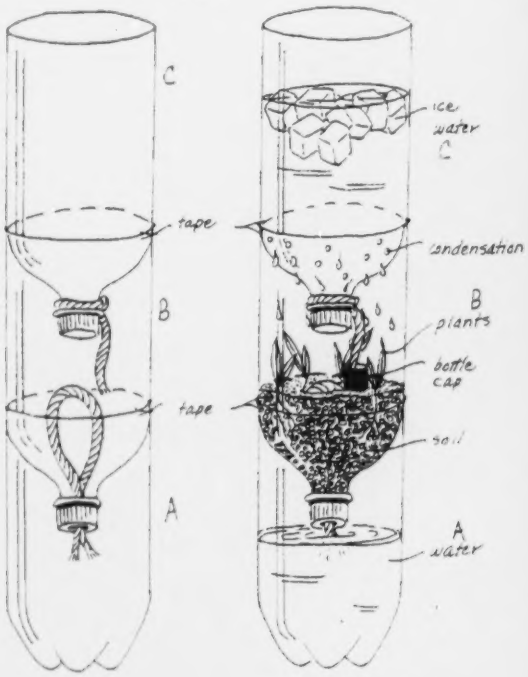


Discussion

1. What are signs of the hydrologic cycle in the real world? (Evaporation, precipitation) How does the model reflect what happens in the hydrologic cycle? (Water evaporates, and then forms rain.)

2. How does the model demonstrate each of the concepts detailed in the vocabulary listed below?

3. What are potential sources of pollution to water bodies? (motor oil, fertilizer, pesticides, etc.)



Vocabulary

Closed system: A process contained entirely within itself.

Condensation: The process of changing from a vapor to a liquid; a liquid obtained by the coming together of a gas or vapor.

Evaporation: A process in which water transforms into vapor or invisible minute particles.

Pollution: The contamination of a natural resource from the discharge of a harmful substance.

Precipitation: Condensed water vapor that falls to Earth as rain, snow or hail.

Transpiration: A process by which water is released to the air from plants.

This activity was adapted from *The Water Sourcebook*, a series of classroom activities produced by the Georgia Water Wise Council in cooperation with the Environmental Protection Agency. For information call (770) 426-8936, extension 234.

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Splash! water resource education

Desal World

Hey There!

Welcome to Desal World, Florida's water theme park of the future! Desal World is currently under construction, but opening soon in a county near you!

Our Desal World team works 'round the clock, splashineering new ways to produce safe, pure water. Our team has plenty of openings for creative, bright and enthusiastic team players to join us in turning Desal World into one of Florida's biggest water attractions. Visit Desal World today and think *Splash!*

Water is everywhere. Oceans cover two-thirds of Earth's surface. Rivers flow endlessly. Heavy rainfalls bring flooding. So why in the world does Florida need to think up new sources of drinking water?

The clean water that people in Florida drink comes mostly from the Floridan aquifer, a vast underground layer of porous limestone capable of holding a quadrillion gallons of water. The problem is that we pump water out of the Floridan aquifer faster than rainfall can replace it. Draining aquifers to meet the needs of the water supply puts the environment at risk.

The solution to the problem is to find ways to rely less on ground water — but how do you do that?

Learning goals

- To practice problem solving in groups
- To understand some of the issues surrounding limited water resources
- To learn about potential future sources of drinking water
- To stretch the imagination

Subjects

- Fine arts
- Language arts
- Science
- Social Science/Economics

Materials

- pens and crayons
- large paper

Sunshine State Standards

Language Arts: Reading, LA.A.1.3; Writing, LA.B.2.3; Listening, Viewing and Speaking, LA.C.1.3, LA.C.2.3, LA.C.3.3; Language, LA.D.1.3, LA.D.2.3. *Math*: Numbers, Sense, Concepts and Operations, MA.A.1.3, MA.A.4.3. *Science*: Processes that Shape the Earth, SC.D.2.3; How Things Interact with the Environment, SC.G.2.3; The Nature of Science, SC.H.1.3, SC.H.3.3. *Social Studies*: People, Places, and the Environment, SS.B.2.3; Economics, SS.D.2.3. *Fine Arts*: Visual Arts, VA.A.1.3, VA.B.1.3

Activity

1. Divide the students into groups, challenging each group to engineer a new, alternative source of drinking water.

2. Have the students draw what their new process or technology will look like.

Have them analyze their plan from a cost-benefit perspective. How much do they think it will cost to turn the plan into reality? Could the plan potentially harm the environment? Will the benefits to the public be worth the cost?

3. When the groups have had time to complete their plans, have them present and defend their ideas to the class. Share with the class the background information on the back of this sheet — introducing real-world plans to develop alternative water sources.

Extension

Have the students create advertising to promote their ideas. The advertising can take any form — from magazine ads they draw to television commercials they act out as a skit.

Desal World

Background

Once the students have presented their plans, share with them some of the plans that the Southwest Florida Water Management District is actually undertaking to meet the region's present and future water needs with minimal negative impact on the environment.

DESALINATION:

Water, water everywhere — and not a drop to drink!

West central Florida is poised to begin the desalination of Gulf water in the near future. Seawater desalination, a process that removes salt from water, will create an additional source of public supply water and ease some of the stress on traditional water supplies, especially the groundwater aquifers.

The most common process of desalination involves using high pressure to force salty water through a semi-permeable membrane into tanks where it separates into clean water and a brine (salt) byproduct. This process is called reverse osmosis.

At present, roughly 50 plants desalinate brackish water in the SWFWMD. Brackish water is a mixture of fresh water and sea water. It is pumped from aquifers near the coast, where brackish water occurs naturally.

Two traditional drawbacks to desalination have been the high cost of the energy needed to operate the plants and the safe disposal of the plant's highly concentrated brine by-product. Researchers are finding new ways to desalinate water with greater energy efficiency and to dilute the brine and return it safely to the Gulf so that it doesn't harm marine life.

ASR:

Saving water for when it's *not* a rainy day

The Aquifer Storage and Recovery (ASR) process involves taking water from a river during periods of high flow, purifying it, and then pumping it into underground aquifers. Researchers have discovered that aquifers can serve as safe and inexpensive water-holding vessels with enormous capacity. The ASR process uses the same pumps and wells that currently draw water out of the ground. Later, during dry periods, it is recovered from the ground water, treated and used for public supply.

SURFACE WATER:

Drinking water the river gives

Water from the Manatee, Hillsborough and Peace rivers and three streams currently provides more than 100 million gallons of drinkable water per day. The water is treated and then used for public supply. The use of surface water must be carefully managed to protect natural resources from damage.

RECLAIMED WATER:

Old water never dies

Reclaimed water is defined as water having received treatment at least twice in a wastewater treatment plant. Reclaimed water is currently used to water lawns and landscapes (particularly at golf courses and cemeteries), to cool power plants, and to recharge groundwater supplies. Although it is often clean enough to drink, it is kept out of the public water supply.

STORMWATER:

When it rains, we store

Water that flows across land as a result of rainfall is called stormwater. Once it is collected, stored and treated, it can be used much like reclaimed water. Stormwater also can be made to flow into constructed wetlands where it provides habitat and aesthetic benefits. Like reclaimed water, it is not used for public supply.

CONSERVATION:

Water saved is water earned

As useful as all of these methods are, nothing tops conservation as a means of preserving west central Florida's water resources. The Southwest Florida Water Management District promotes conservation through several programs that teach students and community members ways to save water. For more information about in-school or community education, Xeriscape, plumbing retrofit, leak detection, or other District-sponsored conservation programs, call 1-800-423-1476, extension 4757.

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Splash
water resource education

Desal World II

Construct Your Own Mini-Desal Plant

In the first Desal World activity, you used your imagination to drum up new ideas for alternative sources of drinking water. This time around, you will use your hands to build a solar-powered desal plant of your own — and turn your classroom into Desal World!

Learning goal
To learn about an alternative source of drinking water through a hands-on activity

Subject
Science

Materials
- one egg
- two 2-liter plastic soda bottles
- black paint
- one foot of clear plastic tubing, 1/2" or 1 cm diameter or larger (as for an aquarium)
- duct tape
- salt
- water
- bowl

Sunshine State Standards
Science: Force and Motion, SC.C.2.3; How Living Things Interact in the Environment, SC.G.2.3; Nature of Science, SC.H.1.3, SC.H.3.3

Activity
1. Before class, with safety in mind, spray one of the 2-liter bottles black.
2. In a clear pitcher, mix 1/2 cup of salt in a quart of water.
3. Pour the salt water into the black 2-liter bottle.
4. Attach the clear tubing to both 2-liter bottles and secure with duct tape. See diagram on reverse.
5. Set both bottles in a sunny window. Place the black bottle higher than the clear bottle.
6. After several days, water will have moved from the black bottle to the clear bottle.
7. In order to show the change in the saltiness of the water *without* tasting it, try the low-tech egg test. In a bowl of salt water, a raw egg will float; in fresh water, it will sink. Use the egg test before and after the activity to note the change in the water's salinity. Another optional instrument that will determine precisely the change in the water's salt content is a hydrometer.

Background
A gulp or two while swimming in the ocean or Gulf isn't so bad, but could you imagine drinking nothing but salt water? Salt water doesn't refresh a human body — it actually makes a person more thirsty! Eventually a person on a saltwater diet would become ill from dehydration.

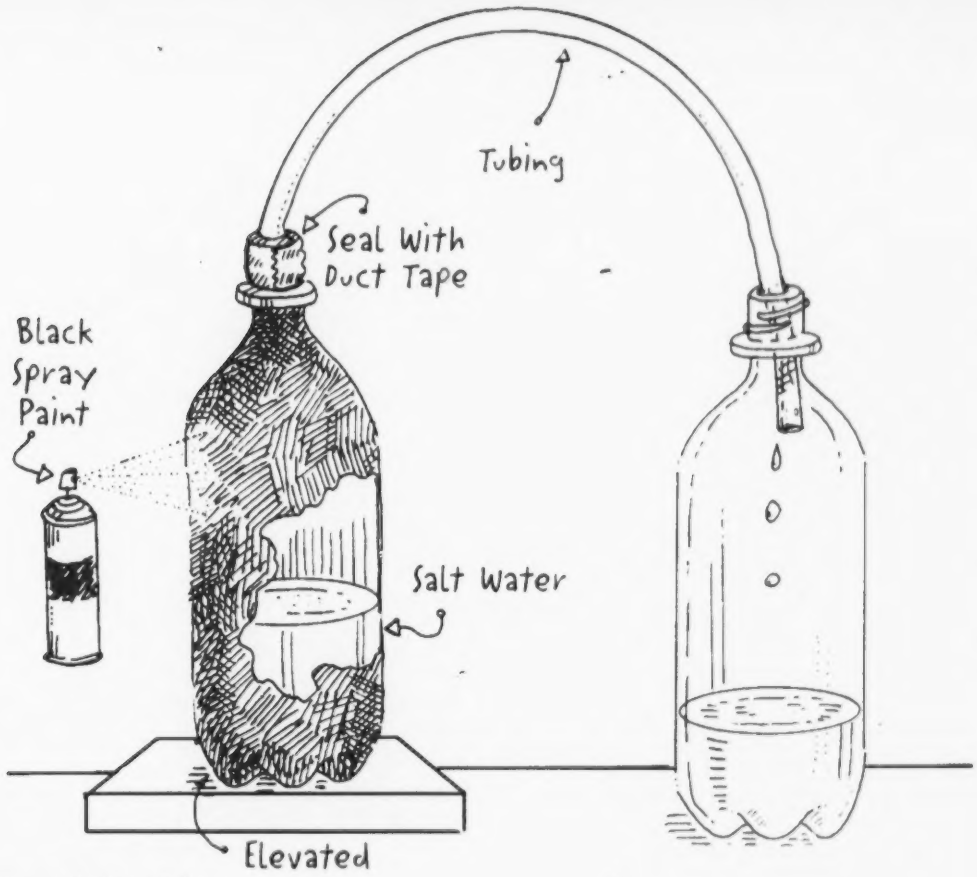
Humans cannot survive on salt water alone — unless, of course, the salt is removed.

Over the last 50 years in seaside population centers where drinking water is scarce, **desalination plants** have been built that turn salt water into fresh water. Currently in Florida, roughly 180 desal plants purify brackish water (a mixture of salt water and fresh water). At present, no desal plants purifying sea water are operating in west central Florida. The **Southwest Florida Water Management District**, working with local governments and other agencies intend to have seawater desalination plants operating in the future.

One way to purify salt water is through a process called **distillation**. Distillation means heating the water until it boils and turns into steam. The steam is then collected in a separate container. When the steam cools and returns to liquid form, it is pure enough to drink.

The problem with this method is that it requires a vast amount of energy to produce small amounts of purified water. The expense of the energy has caused most places to seek alternatives other than saltwater distillation.

Desal World II



Background (cont.)

Another new technology used to desalinate water is called **reverse osmosis**. Though reverse osmosis may sound difficult, the process itself is actually simple. High pressure pushes salt water through a membrane. A membrane is made from material that allows liquid but not solids (like salt) to pass through it. After the water has passed through the membrane, what is left is purified water and a brine by-product (salt). Reverse osmosis is expensive — though cheaper than distillation.

Two traditional drawbacks to desalination include the high cost of the energy needed to operate the plants and the safe disposal of the brine. These factors have made researchers find new ways to desalinate water with greater energy efficiency and to dilute the brine and return it safely to the Gulf so that it doesn't harm marine life.

Water that currently comes out of the tap costs less than half a penny to produce per gallon. While desalinated water will cost more to produce, it will still cost less than one-half penny per gallon to produce.

Seawater desalination can potentially ease the strain on traditional water sources, especially the groundwater aquifers from where most of west central Florida's water is drawn. Desalination, however, will meet only a small percentage of our water needs. With or without seawater desalination, **Floridians need to conserve water!**

Discussion

- Why can't people drink salt water? [It causes dehydration.]
- Which desal process does your model most closely resemble, distillation or reverse osmosis? [Distillation]
- Do you believe the benefits of desalination are worth the extra cost?

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Language Art
Science
Social Science

Splash! water resource education

Waterful, FL

Design a New Florida Town

In the old days, settlers sought the most beautiful and convenient places to build their towns. This was when the number of people living in Florida was few and the water was plentiful.

After the initial settlers, many more people moved to Florida, causing the environment to change. Today people continue moving here and the water resources are showing signs of stress.

Imagine establishing a new town in the 1990s. Think of all the factors that must be considered. Can a new town bring in thousands of new residents without harming the environment?

Finding a balance between making room for all the people who want to live in Florida and preserving the environment is the goal of this activity. In it, your students will create plans to build a new town — Waterful, Florida. In creating their plans, the students will weigh the economic and environmental consequences of building the new town. The students will apply their personal values while forming their plans. The **Southwest Florida Water Management District** assists city and county planners in 16 west central Florida counties in making decisions about growth and the protection of water resources.

Learning goals

- To apply personal values to problem solving in a small group setting
- To learn about balancing the needs of people and the preservation of the environment and water resources

Subjects

- Language Arts
- Science
- Social Science

Materials

- photocopies of Waterful map, class set
- photocopies of student activity sheet, class set
- butcher paper

Sunshine State Standards

Language Arts: Reading, LA.A.1.3; Listening and Viewing, LA.C.1.3, LA.C.2.3, LA.C.3.3; Language, LA.D.2.3. *Science:* How Living Things Interact with Their Environment, SC.G.2.3; the Nature of Science, SC.H.1.3, SC.H.2.3. *Social Studies:* Time, Continuity, and Change, SS.A.4.3; People, Places, and Environments [Geography], SS.B.1.3, SS.B.2.3, Economics: SS.D.1.3

Activity

After the students become familiar with the goals of the activity as explained on the student activity sheet, divide the class into groups of three or four and have the students work on preparing a plan and a class presentation.

Following the presentations, lead a class discussion covering the issues that mean most to the students in thinking about the effects of people on the environment and water resources.

Extension

Who Gets the Water?, a middle-school curriculum available from the Southwest Florida Water Management District, features a number of student activities based upon balancing economic and environmental concerns. The curriculum is available through teacher workshops. See the teacher workshop flyer included in the *Splash!* packet.

Student Activity Sheet — W

Play the role of city planners given this assignment: design a new city in an undeveloped area along the Gulf coast. When designing your city, keep in mind these two factors:

- **The city needs to accomodate future population growth. According to estimates, the population of west central Florida will increase by 30 percent between the mid-1990s and 2020.**
- **The city needs to cause the least possible harm to water resources and the environment.**

The new city will be called Waterful. As the name suggests, there is enough water in Waterful for everybody — as long as the water resources are not abused. In planning the town, you will want to avoid design features that disrupt **wetlands** and/or cause **water pollution**.

In groups of three, discuss various ways to build a new town along the Gulf Coast in what is now a wilderness area. As your group reaches agreement on design, draw the town's layout on the map provided to you or draw the map on a sheet of butcher paper. When your group is finished, present your design to the rest of the class, explaining the reasoning behind the decisions you made in planning your city.

The **Southwest Florida Water Management District** is the local agency responsible for managing water resources. The SWFWMD's Planning Department provides city governments with the best available information in making decisions about growth that will cause the least amount of harm to the area's water resources. The concerns faced by city planners are the same ones you will encounter in this activity.

These are the urban elements Waterful will need to become an established Florida city:

- Roadways/Highways
- Bridges
- Wellfields for drawing drinking water from aquifers
- Housing subdivisions/Apartment complexes
- Business/Shopping Districts
- Parks
- Schools/City Hall/Fire/Police

Focusing your plan: Before beginning your design, become familiar with the following four points of city planning with a water resource/environmental focus:

- **Water Supply**
  Making sure there is enough water for everyone without damaging the environment is one of your primary concerns. **Aquifers** provide a clean, safe supply of drinking water to residents of west central Florida. Sometimes **wellfields** draw water out of aquifers faster than rainfall can replace it; when this happens the area becomes susceptible to environmental degradation. One way to protect aquifers is by providing ample **groundwater recharge** areas. A recharge area is a place where water seeps into the ground. By preserving these areas, the aquifers have a better chance of replenishing themselves and providing an adequate water supply.

- **Water Quality**
  A major source of water pollution is **stormwater runoff**. It picks up pollutants such as road grease, fertilizer, etc. which then flow into rivers, lakes and other natural water bodies. This pollution can have far reaching effects. For example, water pollution can reduce fish habitat, causing fish populations to dwindle. This will in turn affect other species in the **ecosystem** (bald eagles, among others) that depend on fish for food. Following best environmental practices will help keep polluted stormwater from reaching natural water bodies.

- **Flood Protection**
  Wetlands temporarily store floodwaters, protecting property owners downstream from severe flooding. They also slow floodwater velocities, lowering wave heights and reducing soil erosion. Researchers at the University of Florida discovered that when wetlands make up as little as 10 percent of the landscape, flooding decreases by 60 percent. When wetlands cover 20 percent of an area, flooding decreases by 90 percent. Preserving wetlands in your design can potentially reduce flooding in Waterful.

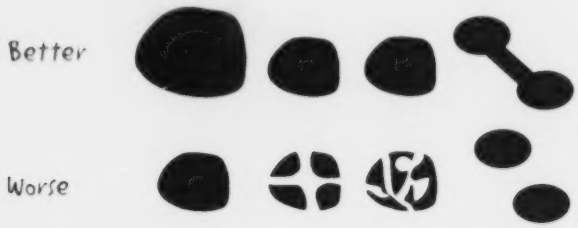
- **Natural Systems**
  Fish, birds and other wildlife need ample, undisturbed habitat to prosper. Wetlands, rivers and lakes house hundreds of animal and plant species — many of which are currently endangered. Long, connected corridors are called greenways. Birds follow greenways while migrating between northern and southern climates. Other animals, like bears, will pass through greenways in search of food. Preserving long, connected wilderness patches along the outskirts of an urban area will help protect several animal and plant ecosystems.

aterful, FL - Est. 1999 - Pop.?

These are six Best Environmental Practices you can use to plan your city while protecting water resources and the environment:

Practice 1: When planning, consider the whole system rather than a sum of individual parts. This is called a "systems" approach. In the environment, animals and plants are interconnected both to each other and the habitats where they live. Think of your plan as a jigsaw puzzle — if one piece is missing, the puzzle will always be incomplete.

Practice 2: Preserve large, connected and circular patches of high quality habitat. The bigger the patch, the more animals will live there. The following diagram will show you better and worse designs for preserving greenways and wilderness patches.



Can you explain why certain habitat designs are better than others?

Practice 3: Design around significant wetlands. Wetlands recharge surface waters, prevent flooding, filter stormwater and provide critical habitat for several species. For these reasons it is important to protect them. The law regulates the kinds of construction that can take place in wetlands.

Practice 4: When disrupting a wetland, build a new wetland elsewhere. A "replacement" wetland is called a **mitigation site**. The law requires developers to build, enhance or reclaim mitigation wetlands to replace wetlands that are destroyed during construction.

Practice 5: Preserve significant uplands, too. While wetlands are usually protected by the law, upland forests aren't. Upland forests are usually ideal places to build, because they are well drained, shaded and beautiful. Upland forests house different plants and animals than wetlands. When possible, preserve upland forests and the ecosystems housed there.

Practice 6: Create constructed wetlands, detention ponds and swales to remove pollutants from stormwater. These design features are effective, natural ways of filtering out road grease, fertilizer and other pollutants carried in stormwater runoff. Place these features between populated areas and natural water bodies. They will filter out the stormwater before it reaches the water body. See the Vocabulary list to learn more about these features.

Vocabulary

Becoming familiar with these words will help you understand the processes you will use in creating your plan.

Aquifer: A layer of underground rock or sand which stores and carries water.

Best Environmental Practices: Strategies for city planning that cause the least harm to the environment.

Constructed wetland: Cities and developers can turn tracts of land into new wetlands. These wetlands are built to filter stormwater, create habitat and/or serve as mitigation sites.

Detention pond: Constructed ponds that capture stormwater and hold it long enough for many of its pollutants to settle to the bottom. The relatively contaminant-free water that overflows from these ponds then feeds into natural water bodies. These ponds are monitored frequently and the contaminated sediments are removed.

Ecosystem: A community of living organisms.

Groundwater recharge: The process of water above the ground feeding into groundwater aquifers.

Mitigation site: A place where a wetland has been built, enhanced or reclaimed to replace a wetland that was disturbed by construction.

Recharge area: Parcel of land important to replenishing groundwater aquifers.

Stormwater runoff: Rain water that runs over land toward the lowest point of gravity. Often it picks up pollutants which can then pollute water bodies.

Swale: A gently sloping depression in the land surface designed to hold, filter and transport stormwater runoff.

Watershed: The land area from which surface runoff drains into a stream channel, lake, reservoir, or other body of water.

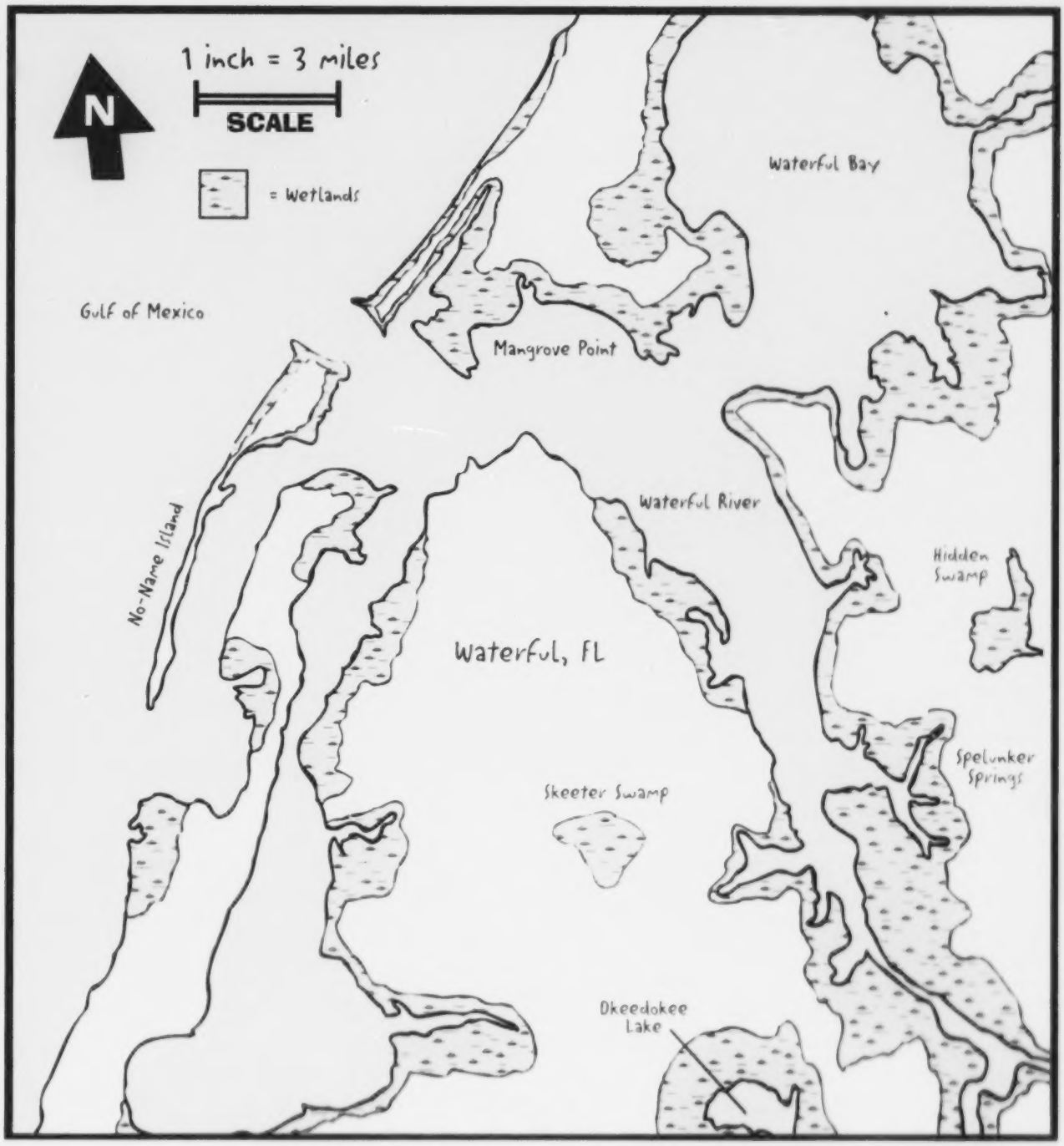
Wellfield: An area where large quantities of goundwater are pumped for public supply or other use

Wetland: An area of land where the s s saturated for several months throughout the year. Wetlands are valuable beacause they recharge surface waters, purify stormwater, slow and prevent flooding and provide habitat.

Best Environmental Practices were adapted from Best Development Practices produced by the Florida Department of Community Affairs.

BEST COPY AVAILABLE

Future Site of Waterful, Florida



Note to Teachers: This color sheet has been designed for reproduction in a black and white photocopy format.

In small groups, plan the building of a city. Then draw on the map what you would build and where. When you have finished, present your plans to the class. See the activity page for design considerations.

Southwest Florida Water Management District

Protecting Our Water Resources

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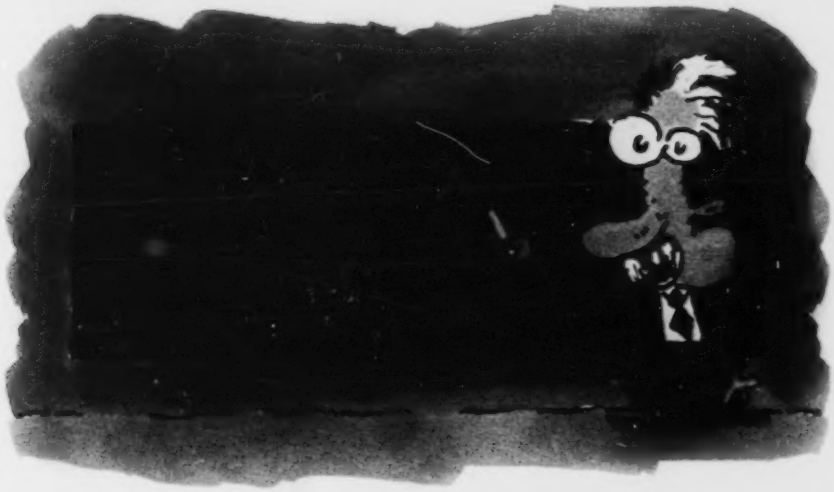
Splash
water resource education

Water By The Numbers

You Count on Your Drinking Water — Your Drinking Water Counts On You



The Southwest Florida Water Management District is the agency responsible for managing the water resources in all or part of 16 west central Florida counties. Encouraging water conservation is one of the SWFWMD's primary aims. The following facts and statistics will show you how important water conservation is to the preservation of the region's water supply.

The World

- Oceans cover two-thirds of Earth's surface and hold 97 percent of the planet's water.
- Only 3 percent of Earth's water is fresh water — or in other words, is pure enough to drink.
- Of all Earth's fresh water, glaciers contain two-thirds. The Great Lakes hold another one-fifth of the world's fresh water.
- If the size of this sentence represents all of Earth's water, the period at the end represents the amount of available fresh water safe for humans to drink.

West Central Florida

- Of all the water used within the Southwest Florida Water Management District, 80 percent comes from groundwater aquifers. While agriculture and industry often use reclaimed water, nearly all of the water in the public supply comes from aquifers.
- In the region covered by the Southwest Florida Water Management District, an average of 53 inches of rain falls each year. Of our yearly rainfall, 75 percent evaporates back into the atmosphere, 13 percent runs off as stormwater and contributes to rivers and lakes. This leaves 13 percent of our yearly rainfall to replenish groundwater aquifers. These numbers vary throughout the region.
- The population of Florida has increased more than 500 percent since 1950. According to estimates, west central Florida's population will increase by nearly one-third between the mid-1990s and 2020. Water use is expected to increase proportionally.
- The average number of gallons used per person each day in west central Florida: 112. The average person drinks only half a gallon per day.

Water By The Numbers

Where You Live

- If you brush your teeth with the water running, you let 10 gallons flow down the drain. If you turn off the faucet while brushing, you will probably use less than 1 gallon.

- The average toilet flush in Florida uses 5 gallons of water. While most toilets in the region use 3.6 gallons per flush, many older models use substantially more and drive up the average. Newer low-flow models use a little as 1.6 gallons per flush. Most of the water people use in their homes swirls down the toilet bowl. A leaky toilet can waste thousands of gallons per year.

- Most showers use 4 gallons a minute, although variations in water pressure and shower heads can change that number considerably. A low-flow shower head uses 1.5 gallons per minute.

- Filling a bath takes between 40 and 60 gallons of water. Taking a bath with the tub half full can save 20 to 30 gallons.

- Faucets, whether in the kitchen or the bathroom, generally use 4 gallons a minute. Low-flow models use as little as 2.75 gallons per minute.

- Dishwashers generally use 13 gallons per load — in most cases, that's less than when you wash dishes by hand.

- Standard washing machines use an average of 35 gallons per load. Older machines use up to 43 gallons, while newer water-saving models use only 28.

- Watering the yard accounts for between 25 and 50 percent of all residential water use in the SWFWMD. A hose is capable of spraying 10 gallons per minute.

- If you wash a car and leave the hose running, you waste more than 100 gallons. If you use a trigger nozzle, bucket and rag, washing your car can use roughly 15 gallons.

Saving water can have a tremendous effect on the preservation of west central Florida's water supply. Simple water-saving activities can add up to thousands of gallons saved each year!

Water Log

Have your students use their math skills to determine how many gallons a minute pour through faucets around their home and school.

Learning goal

To calculate the number of gallons per minute that flow through various faucets

Subject

Math

Materials

- gallon-size plastic jug/container
- stopwatch

Sunshine State Standards

Math: Number Sense, Concepts, and Operations, MA.A.1.3; Measurement, MA.B.4.3

Activity

Have students fill the jug with water from a faucet or drinking fountain while using the stopwatch to see how long it takes the fixture to fill a gallon container. Have them write down the results and convert their numbers into gallons per minute. After filling the jug each time, have the students use the leftover water to refresh a shrub or tree.

To calculate gallons per minute, the students will need to use one of two formulas.

If it takes less than one minute to fill the gallon jug, then use this formula:
60 divided by the number of seconds to fill the gallon jug. **Example:** 60 divided by 10 seconds to fill the jug = 6 gallons per minute

If it takes more than one minute to fill the gallon jug, then mark down the time as it was recorded. **Example:** If it takes 3 minutes and 30 seconds to fill the jug, write down 3:30.

Have the students record the data from three to five different fixtures around the school or their homes. Using the data they collect, the students can create their own "Water Log." They can plot their data on graphs to show the difference between fixtures in terms of gallons per minute.

Extension

For an additional activity in which students measure their own personal water use, see the *Splash!* activity called "Showerlock Holmes."

Southwest Florida Water Management District

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Showerlock Holmes

A Simple Case of "How Much?"

"Egads!" yelped Dr. Watson when he saw the headline splashed across the front page of *The News*. He read it again: ***Water Use Tops 100 Gallons Per Person Daily in West Central Florida***. "I cannot believe it," he muttered under his breath. He imagined that if one milk jug holds 1 gallon, then he must be using enough water to fill 100 milk jugs per day. The thought was astounding! And he wasn't alone, either. If the newspaper report was true, then everyone is using that much water.

The good doctor called his friend, the detective Showerlock Holmes. The detective, sensing Dr. Watson's distress, raced to the scene.

"How can it be?" Watson asked. "How can people possibly use that much water?"

"It's true Watson. People use between 100 and 150 gallons of water per day."

"I can't believe my ears."

"Let's solve this mystery by finding out for ourselves how much water people use," Holmes suggested.

"How do we go about that?"

"Elementary arithmetic, my dear Watson," Holmes replied. "We'll start here in your home."

(turn to back of page)

The Southwest Florida Water Management District provides this home water audit designed for middle-school students.

Protecting Your Water Resources

Splash

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Showerlock Holmes

A Simple Case of "How Much?"

Exhibit A: SHOWERS
Multiply: number of showers per day by the average number of minutes per shower = _____

Exhibit B: BATHS
Number of baths per day = _____

Exhibit C: TEETH
Multiply: number of people in household by average time they brush their teeth per day = _____

Exhibit D: TOILET
Multiply: number of people in household by 4 (the average number of times people flush) = _____

Exhibit E: DISHES WASHED BY HAND
Multiply: number of times dishes are washed by hand daily by minutes the water runs = _____

Exhibit F: DISHWASHER
(answer only if you use one)
Divide: number of loads per week by 7 (days per week) = _____

Exhibit G: WASHING MACHINE
(answer only if you use one)
Divide: number of loads per week by 7 (days per week) = _____

Exhibit H: YARD WATERING
(answer only if you do so)
Multiply: number of watering days per week by watering minutes per day = _____

Now, **divide:** total watering minutes by 7 (days per week) = _____

Exhibit I: OTHER USES
What are some other indoor uses of water?

_____
_____
_____ = 10 gallons per day
(10 gallons per day are estimated to represent other uses)

Multiply: 10 gallons per day by number in the family = _____

WATSON: By George, now we have some numbers! What do we do now?

HOLMES: Relax, good Doctor. Fill in the numbers you gathered in the spaces provided on the chart below. Multiply the numbers given to you in the first column by the numbers you have recorded. Then add the numbers in the final column together and that will give you the answer you are seeking!

Exhibit A	Showers	5 gal./minute	x	_____	=	_____
Exhibit B	Baths	36 gal./bath	x	_____	=	_____
Exhibit C	Toothbrushing	3 gal./minute	x	_____	=	_____
Exhibit D	Toilet flushes	5 gal./flush	x	_____	=	_____
Exhibit E	Hand dishwashing	3 gal./minute	x	_____	=	_____
Exhibit F	Dishwasher	13 gal./load	x	_____	=	_____
Exhibit G	Laundry	35 gal./load	x	_____	=	_____
Exhibit H	Yard Watering	10 gal./minute	x	_____	=	_____
Exhibit I	Other uses					_____

Add the numbers in that column together

WATSON: But, Holmes! That number is way too high!

HOLMES: Yes, but there is still one final step. That number represents the water used by everyone in your home. Divide it by the number of people living in your household, and *voila*! You now have the average number of gallons used per person daily in your home!

_____ ÷ _____
answer you are seeking # in household

= [ ]
Average Number of Gallons Used Per Person Daily in your home

Splash
water resource education

Building A Wetland

See What Wetlands Do

Wetland. Wasteland. The two words were synonymous until recently. Today wetlands are valued not only for the habitat they provide to a variety of plant and animal species, but also for the benefits they bring to cities and water resources. Here are a few examples:

- **During storms, wetlands slow down floodwaters as they enter rivers and streams. By doing so, wetlands reduce flooding.**
- **Wetlands help filter sediment and pollution from stormwater runoff before it reaches rivers and streams.**
- **Slowing the rate of soil erosion is another function of wetlands.**

The **Southwest Florida Water Management District** preserves wetlands for the water's sake. With your class, you can build a wetland model that will demonstrate these functions to the students and show why wetlands are now considered precious.

Learning goals

- To teach the function of wetlands
- To stimulate thought about the role wetlands play in the world

Subjects

- Science
- Social Science

Materials

- glass lasagna pan (or clear plastic sweater box)
- modeling clay
- turkey baster
- strip of indoor-outdoor carpet, 3 inches wide by the width of the pan
- clear water
- muddy water

Sunshine State Standards

Science: Processes that Shape the Earth, SC.D.1.3, SC.D.2.3; How Living Things Interact with Their Environment, SC.G.1.3, SC.G.2.3; The Nature of Science, SC.H.1.3, SC.H.2.3. *Social Studies:* People, Places and Environments, SS.B.2.3

Activity

1. To set up the activity, spread a layer of the clay in half of the lasagna pan or sweater box to represent land. Leave the other half of the pan empty to represent a lake or other body of water. Shape the clay so that it gradually slopes down to the body of water as in the diagram on the back of this sheet. Smooth the clay along the side to seal the edges. Cut a piece of indoor-outdoor carpeting that will completely fill the width of the pan along the edge of the clay. This represents the wetland. Do not place the carpet into the model yet.

2. Demonstrating to the class, use the turkey baster to pour clear water slowly over the clay. This can represent rainfall. Ask the students to observe what happens. (The water runs over the clay and into the depression.)

3. Use the baster to drain the water from the model back into its original container. Show the students the strip of carpeting and ask them to imagine that it represents a wetland. After you place the strip in the model, ask the students to predict what will happen when you pour water onto the clay again.

4. Explain that most wetlands are shallow basins that collect water and slow its rate of flow. Using the model, explain how this helps reduce flooding. Pour the same amount of water onto the model again. Let the students describe what happens. (The water will drain more slowly because it is hindered by a wetland.)

Building A Wetland

Activity (cont.)

5. Drain out the clear water. Leaving the carpeting in place, pour some muddy water onto the clay. Ask the students to compare the water that flows through the wetland into a body of water with the water left in the jar. (The water that passed through the wetland is clearer.) This demonstration shows the ability of wetlands to reduce soil erosion and filter stormwater pollutants.

6. Remove the carpeting and again pour the muddy water over the model. Show what would happen if wetlands were not there to act as a water filter. (All of the pollutants flow directly into the water body.)

Discussion

- Even though wetlands cover nearly one-third of the state's landmass, Florida has lost nearly half of its wetlands since pioneer times due to development or other alteration. What will happen if Florida continues to develop and alter its wetlands in order to accommodate more people? [Greater risk of flooding, more water pollution and erosion, etc.]

- Researchers at the University of Florida have found that when wetlands make up as little as 10 percent of the landscape, flooding is reduced by 60 percent. When wetlands cover 20 percent of an area, flooding is reduced by 90 percent. Are wetlands valuable in areas where recurring flooding costs homeowners, business owners, and insurance companies millions of dollars?

- **Sediment** and other pollution that reach rivers and streams adversely affect populations of fish and other aquatic animals. This in turn affects animals in the **ecosystem** such as bald eagles who depend upon fish for food. What role do wetlands play in the health of the ecosystem? [Wetlands help keep water clean.]

- Healthy topsoil is important to plant growth. What happens to the **ecosystem** if the loss of topsoil due to soil **erosion** suppresses plant growth. Would humans be affected? [Fewer natural plants would likely result in more water and air pollution — and cause a threat to public health..]

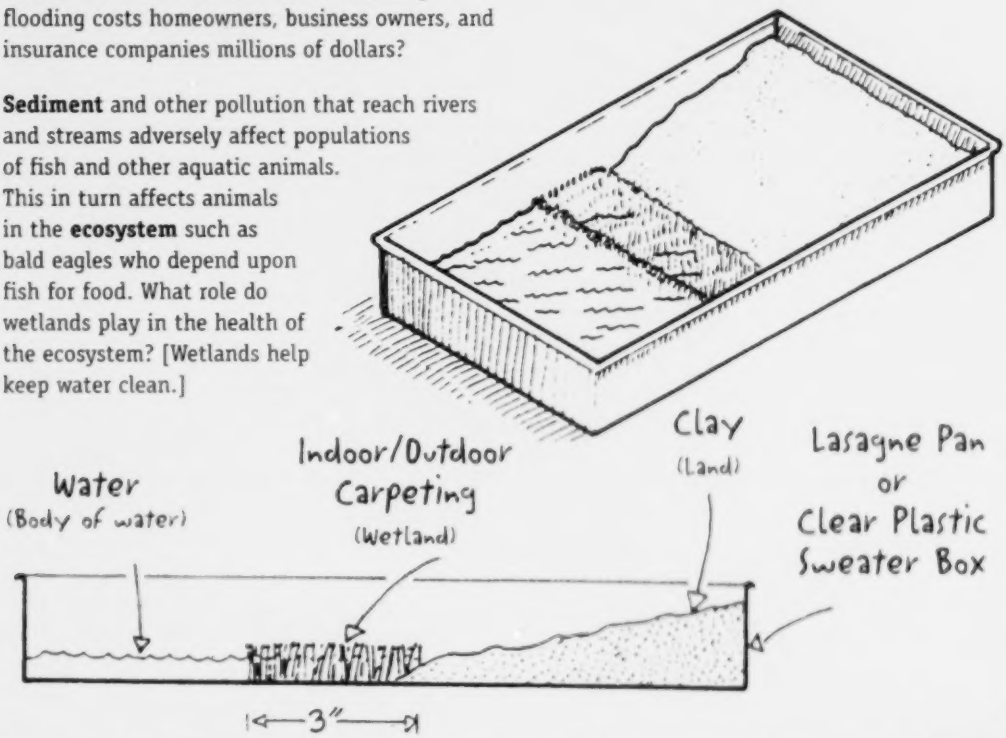
Vocabulary

Ecosystem: A community of living organisms.

Erosion: Rain or wind causing the loss of topsoil is called erosion. Topsoil is important for the healthy growing of plants and food. As little as an inch of lost topsoil takes thousands of years for nature to replace.

Sediment: Soil that finds its way into rivers, streams and lakes. Sediment adversely affects the passage of fish through water. It often contains pollutants such as road oil and heavy metals. Because of extensive soil erosion, sediment is the leading pollutant of rivers and lakes in the world.

This activity was adapted from the *Water Sourcebook*, a series of classroom activities produced by the Georgia Water Wise Council in conjunction with the Environmental Protection Agency. For more information, call (770) 426-8936, extension 234.



Southwest Florida Water Management District

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Language Arts
Fine Arts
Science
Social Science

Splash
Water resource education

Old Water Tales

Trace a Drop's Travels Through Time

It's a long way down, but the landing is actually soft. It's not like I'm the first one ever to take this plunge. I think I landed in the ocean this time. Some of the locals seem kind of salty — but I don't mind the ocean at all. The dolphins are pleasant, and the waves keep us busy. The only downside to being here is that in the ocean you join up with so many other drops that you can lose your sense of individuality. The clouds that dropped us here are passing. The sun is warming us up. Looks like a short stay here this time. The ride skyward is slow — it's the quick flight plummeting back down that I like most.

Learning goals

- To learn about the water cycle
- To practice creative writing skills
- To stretch the imagination

Subjects

- Language Arts
- Fine Arts
- Science
- Social Science

Materials

- pens
- paper

Sunshine State Standards

Language Arts: Reading, LA.A.1.3; Writing, LA.B.1.3, LA.B.2.3; Listening, Viewing and Speaking, LA.C.1.3. *Science:* Processes that Shape the Earth, SC.D.1.3; How Living Things Interact with Their Environment, SC.G.1.3, SC.G.2.3; *Social Studies:* People, Places and Environments, SS.B.2.3. *The Arts/Visual Arts:* Applications to Life, VA.C.1.3, VA.E.1.3

Activity

Ask the students to write a story tracing the journey of a water drop through the hydrologic cycle. The drop may move through currents of a river, swirl through ocean depths, float through the atmosphere, and rain down anyplace in the world. The drop can take the form of snow, sleet, or hail. Any person in history can come into contact with the water drop. The drop can exist in the past, present or future.

The goal is to inspire creativity. The only "rule" is that the drop keep moving through the phases of the hydrologic cycle until it returns to the same state in which it started.

Extension

- Have the students draw a map of their drop's travels. Have them draw pictures of the places it goes.

- Challenge the students to make a drawing or painting of water. It's not as easy as it sounds!

Background

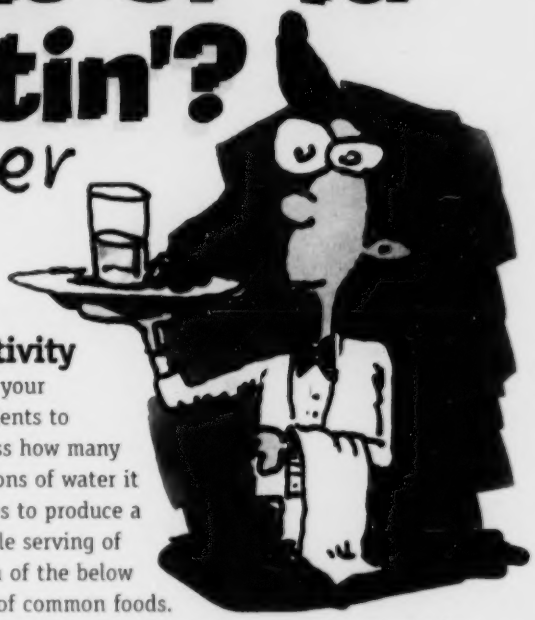
- Usually it takes several years for a raindrop that falls in central Florida to soak into the ground and pass through the ground water and cycle back into the ocean. Once evaporated, a water molecule spends approximately 10 days in the air.

- NASA's Polaris spacecraft in 1997 photographed a steady stream of water drops the size of small houses pelting Earth's upper atmosphere from outer space. The enormous drops then vaporize into the atmosphere. Scientists do not yet have enough information to know how this constant "cosmic rain" affects the hydrologic cycle. With this idea in mind, the students can even take their drop's adventures into outer space.

Splash
water resource education

Wat-er Ya Eatin'?

We Eat More Water Than We Drink



We drink water to live, but did you know we use more water than we could ever drink — when we eat?

Learning goal

To build appreciation for the magnitude of water needed to produce food

Subjects

- Language Arts
- Math
- Science
- Social Science

Sunshine State Standards

Language Arts: Listening, Viewing, and Speaking, LA.C.1.3. *Math:* Number Sense, Concepts, and Operations, MA.A.1.3. *Science:* Processes that Shape the Earth, SC.D.2.3. *Social Studies:* People, Places, and the Environment, SS.B.1.3

Background

People engage in two kinds of water use: **direct** and **indirect**. Turning on a faucet, taking a shower, watering the yard, etc. are direct uses of water. By comparison, the water that goes into producing the food people eat and the various products they use and consume constitutes indirect uses of water.

All of the food we eat requires water to grow. Water for growing food is supplied either by rain (or other precipitation) or is added through irrigation. Even more water is needed when the food is cleaned and processed. The size and texture of the food will not reveal how much water was used in producing it.

Share these "oh, wow!" statistics with your students about the foods people eat. This will help them understand their personal indirect water use — and the magnitude of water required to produce food.

Activity

Ask your students to guess how many gallons of water it takes to produce a single serving of each of the below list of common foods. The actual numbers are sure to "wet" your appetite:

1. **Lettuce**
2. **Chicken**
3. **French fries**
4. **Almonds**
5. **Rice**
6. **Watermelon**
7. **Hamburger**
8. **Steak**
9. **Tomatoes**
10. **Milk**

Extension

- Ask your students to plan picnic meals for four people using the foods listed above. Have them list the foods they chose and calculate the number of gallons of water that went into making the meals.

- Roughly 3.7 million people live within the **Southwest Florida Water Management District**. Have your students calculate how much water would go into producing enough food for one day's worth of meals for everyone living in the SWFWMD. Answers will vary.

Source: U.S. Geological Survey

Answers:

1.	6	6.	100
2.	408	7.	1,303
3.	6	8.	2,607
4.	12	9.	3
5.	36	10.	65

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water resource education

WATER RESOURCES WORKSHOP

Sponsored by:
the Southwest Florida Water Management District

WHO? Educators within the Southwest Florida Water Management District.
ALL GRADE LEVELS, ALL DISCIPLINES

WHAT? A **free** seven-hour workshop packed with information you can use to help students gain the knowledge, skill and commitment needed to make informed decisions about their water resources.

COST? FREE

Workshops are designed to focus on your areas of interest but generally include the following components:

- ✔ Basic hydrologic/geographic information about local water resources.
- ✔ A discussion of important water resource issues surrounding water management.
- ✔ A groundwater model demonstration.
- ✔ Opportunities for hands-on practice of activities.
- ✔ Many resources such as newsletters, tabloids, maps, etc., to help you implement water resource education in your classroom.

Southwest Florida Water Management District
Protecting Your Water Resources

Free Resources for Your Classroom:

We offer six **free** curricula, including *Project WET*, an interdisciplinary K-12 curriculum and activity guide containing 91 easy, fun and effective water-related activities.

HOW TO LEARN MORE: Fill out the form below and mail it back to us.

WATER RESOURCES WORKSHOP INFORMATION REQUEST

Name: _____

School : _____

Address: _____

_____

County: _____ **Phone: ( )** _____

RETURN TO:

Beth Bartos, Education Coordinator
Southwest Florida
Water Management District
2379 Broad Street
Brooksville, Florida 34609-6899
or Fax: (352) 754-6883

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Splash
water resource education

Endangered Species

Wetlands support many of Florida's most popular — and endangered — species. The Southwest Florida Water Management District has acquired several tracts of wetlands in order to preserve the land for the water's sake. Among the many benefits these lands provide are the preservation of feeding and nesting habitats for many of Florida's endangered and threatened birds, mammals and reptiles.

FLORIDA'S MOST ENDANGERED LIST

Imagine travelling back in time a few hundred years and visualize the area where you live. What do you see there? No houses or cars, buildings or streets. Instead you see mostly marshes and grasslands, swamps and forests— hardly touched by humans.

What animals might you see there? In wild grasslands, you might see a red wolf stalking its prey. In an estuary, you might see a West Indian monk seal sunning itself in the warm water. In a large open plain, you might even see a small herd of roaming buffalo.

Florida still has millions of acres of wetlands and wilderness where a variety of animals den and nest, eat and are eaten. However, some animals are missing from the Florida landscape. The wolf, monk seal and buffalo among many others have all disappeared from Florida — they have become extinct. The Florida Game and Fresh Water Fish Commission currently lists more than 100 animals in the state as endangered, threatened, or species of special concern. Each of these species is in danger of becoming extinct unless the harmful factors affecting their habitats cease.

Animals in Florida can become extinct for a number of reasons, ranging from loss of habitat to overhunting, from pesticides to vehicle collisions. Some species have become so fragile that a hurricane or viral infection can cause their extinction. Once a species becomes extinct, it is gone forever.

Many of Florida's most popular animals including the panther, manatee and our national symbol, the bald eagle face the risk of becoming extinct — unless people act in order to save them. Fortunately, people today care now more than ever and are willing to act, giving hope to many of the animals currently listed as endangered species.

Animals are given various classifications by either the federal or state government. Under the federal Endangered Species Act, animals are classified as endangered (the closest to extinction) or threatened. Animals being considered for listing are called candidate species. Federal law gives protection to these species. At the state level, the Florida Game and Fresh Water Fish Commission designates species as endangered, threatened, and species of special concern. Animals given a state listing are protected under Florida law.

This fact sheet contains information about eight of Florida's most famous animals. Each has an endangered species classification. From these descriptions you will learn the kinds of wetland habitat these animals need so they can survive. You will also learn what the animals need from humans to keep from becoming extinct.

FLORIDA BLACK BEAR
Ursus americanus floridanus

Status Threatened species (state listing)

Features Black fur and brown muzzle. The largest land mammal in Florida.

Population Most likely between 1,000 and 1,500 bears live in Florida.

Home A small population of the Florida black bear roams in the Chassahowitzka Swamp and the adjacent coastal wildlife refuge areas in Pasco, Hernando and Citrus counties. Larger populations occur in the Ocala National Forest, the Big Cypress Swamp and other protected wilderness regions across the state.

Habitat Bears live in forests and wetlands including hardwood swamps and cypress swamps. They eat mostly plants. Bears roam in long, connected forest areas.

Outlook Protecting the black bear depends on the preservation of large connected wetlands and woodlands. Bear crossing signs along highways can help reduce the number of bears killed by cars.

FLORIDA SANDHILL CRANE
Grus canadensis pratensis

Status Threatened species (state listing)

Features Grey-to-cinnamon colored plumage. One of Florida's largest birds.

Population Roughly 4,000 cranes live in Florida.

Home Cranes migrate throughout central Florida.

Habitat The habitat of the Sandhill crane includes freshwater marshes dominated by pickerelweed and maidencane. They also require upland forests and grasslands. They often eat seeds, leaves and roots of various plants.

Outlook Protection of suitable plant communities within wetlands is important to the crane's survival.

Cranes are picky eaters!

AMERICAN ALLIGATOR
Alligator mississipiensis

Status Species of special concern (state listing); threatened species (federal listing, due to its similarity in appearance to the endangered Florida crocodile).

Features Elongated reptile with muscular flat tail and long, round shovel-shaped snout. Armored skin on back.

Population Roughly one million alligators live in Florida.

Home Alligators live in marshes and swamps in every county of west central Florida.

Habitat They depend on large, shallow lakes, ponds, rivers, creeks, canals, freshwater marshes, hardwood swamps and cypress swamps.

Outlook Species on the rebound. After nearing extinction in some areas 30 years ago, the species has recovered. Protection of wetlands and strict penalties for poaching have helped. The alligator retains its protected status due to its close resemblance to the crocodile. Only 500 crocodiles remain in Florida.

ROSEATE SPOONBILL
Ajaia ajaja

Status Species of special concern (state listing)

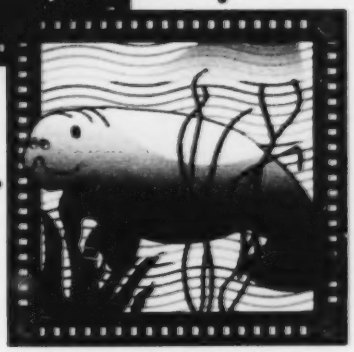
Features A long-legged wading bird with a spatula-like bill and rose-pink feathers.

Population Approximately 880 nesting pairs live in Florida.

Home The Gulf Coast north to Tampa Bay appears to be the population center.

Habitat Roseate spoonbills forage for small fish in shallow marine, brackish or freshwater sites. Wetland habitats include coastal marshes and mangrove swamps. The birds nest in red and black mangroves.

Outlook Species on the rebound. The future of the spoonbills in Florida depends upon protection of estuaries, coastal marshes and mangroves.



SOUTHERN BALD EAGLE
Haliaeetus leucocphalus leucocephalus

Status Threatened species (federal and state listing)

Features White head and tail, chocolate-brown wings and body, yellow eyes, bill and feet. The largest raptor breeding in Florida.

Population Approximately 2,000 individual and nearly 700 nesting pairs live in Florida.

Home Bald eagles nest in and fly over natural areas throughout the region.

Habitat Proximity to water is important. Bald eagles feed mostly on fish. Nesting habitat consists of tall trees with a clear view of the surrounding area. Wetland habitats include freshwater marshes and swamps.

Outlook Species on the rebound. Curbing human activities a mile away from prominent nesting sites can benefit the eagle population.

WEST INDIAN MANATEE
Trichechus manatus latirostris
Also called Sea Cow

Status Endangered species (federal and state listing)

Features Robust, greyish-brown, nearly hairless aquatic animals. The head blends into the rest of the body. Its forelimbs are paddle-like and have nails.

Population At least 1,435 manatees make Florida their winter home.

Home In winter, manatees gather at warm freshwater sources including Crystal River, Homosassa River, Tampa Bay and Fort Myers. Manatees spend summers in Florida's coastal offshore habitats.

Habitat Manatees are frequently encountered at the lower reaches of rivers and in estuaries bordering mangrove swamps and coastal marshes. Manatees forage on a wide variety of aquatic plants including seagrasses and mangroves.

Outlook Additional sanctuaries free from motorboats and development can help protect the West Indian manatee.

FLORIDA PANTHER

Felis concolor coryi

Also called puma, cougar and mountain lion

Status Endangered species (federal and state listing)

Features A large slender cat, tawny on top with a whitish underside.

Population The number of Florida panthers remaining in the wild is probably between 30 and 50.

Home Panthers live in long, connected wilderness areas in the southern part of the region.

Habitat Panther habitat includes swamps and marshes. Panthers eat mostly white-tailed deer, feral pigs, armadillos, and raccoons.

Outlook Hunters used to pose the greatest threat to panthers. Today habitat loss most threatens the panther. The panther does not adapt well to human intrusions and habitat changes. However, the population should remain stable as long as habitat protection continues.

For a list of many District-owned wetlands that you may visit, refer to the *Recreational Guide to Southwest Florida Water Management District Lands*. Call (352) 796-7211 or 1-800-423-1476, extension 4757 to request a free copy.

Southwest Florida Water Management District

Protecting Your Water Resources

WOOD STORK

Mycteria americana

Status Endangered species (federal and state listing)

Features A large, long-legged wading bird with white plumage.

Population Roughly 3,588 nesting pairs live in Florida.

Home Primarily in freshwater marshes and swamps throughout the region.

Habitat Storks fish in water less than 15 inches deep. They will feed in any shallow water where they can find fish. They nest in swamps.

Outlook Species on the rebound. A large number of storks will feed in human-made wetlands or agricultural wetlands. Many nesting colony sites throughout Florida are now protected.

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Splash
water resource education

Wetland Connection

A wetland, by any other Name...

Visualize a cypress swamp where under the trees' thick canopy, day becomes night, where murky standing water covers the ground, where cypress knees poke out from under the water's surface, and where the humming of insects completes the swamp's eerie atmosphere.

Or imagine a coastal marsh where seagrasses wave in the breeze, where shore birds fly overhead, and where tides affect whether the land is wet or dry over the course of a day.

As different as cypress swamps and coastal marshes are, both are wetlands. By definition, a wetland is an area where water saturates the soil for several months each year, usually during the growing season. While all wetlands in Florida have this in common, wetlands vary drastically in appearance, plant and animal habitat value, and other characteristics.

In the **Southwest Florida Water Management District**, there are five primary wetland types:

1. ***Coastal marshes***
2. ***Mangrove swamps***
3. ***Freshwater marshes and wet prairies***
4. ***Cypress swamps***
5. ***Hardwood swamps***

Understanding that each type of wetland is fragile, the SWFWMD promotes the conservation of wetlands. On one level, the SWFWMD regulates what kinds of human activities and development can take place in existing wetlands. The SWFWMD also acquires sensitive tracts of wetlands through state programs such as Save Our Rivers and Preservation 2000. The aim of these acquisitions is to protect the land for the water's sake. In this fact sheet, you will learn about the various types of wetlands you can see throughout the SWFWMD.

Vocabulary

Here is a list of some of the words you will need to know in order to make learning about wetlands easier.

BRACKISH WATER
A mixture of salt water and fresh water found in estuaries and vital to estuary ecosystems.

DECIDUOUS
The kind of trees that lose their leaves once a year. Opposite of evergreen.

ECOSYSTEM
A community of living organisms.

ESTUARY
The area where a river empties into sea water.

EVERGREEN
The kind of trees that keep their leaves year round. Opposite of deciduous.

HARDWOOD
Slow-growing flowering trees with broad leaves.

SALINITY
A word describing the salt content of a liquid.

SATURATED
A condition in which soil has absorbed as much water as it can physically hold.

TIDES
Changes in water level due to the gravity of the sun and moon.

COASTAL MARSH

- These marshes form along the Gulf Coast — often near mangroves. They sometimes extend into rivers.
- The water is salty.
- Because of the water's **salinity**, extended areas of coastal marshes are dominated by a single plant species. These may include saltgrass, cordgrass and blackrush. Few trees can grow in marsh conditions.
- Coastal marshes have a close relationship to nearby estuaries. Salt water moves between coastal marshes and estuaries because of **tides**.
- Waterfront residential development adversely affects coastal marshes.

MANGROVE SWAMPS

- The mangrove trees that make up these swamps form along the Gulf. They are frequently found near coastal marshes.
- Red mangroves form closest to the gulf and have the most exposure to salt water.
- Black mangroves are further inland but are filled with sea water at high tide.
- White mangroves are the furthest inland and have the least influx of salt water.
- Mangroves contribute to the productivity of bordering estuaries. Leaf fall provides food for countless organisms ranging from bacteria to large fish.
- Many of the mangrove swamps are owned by the government and are well protected.

FRESHWATER MARSHES

- Unlike coastal marshes, these wetlands rely on fresh water.
- The plants here are usually wetland grasses, rushes or sedges. You will also find green, non-woody shrubs growing in communities. Few trees grow in marsh conditions.
- Different locations may have marshes dominated by sawgrass, cattails, spike rush, bulrush, and maidencane.
- The soil in these wetlands is **saturated** during at least one month per year during the growing season. These marshes (also called wet prairies) often give the appearance of an overgrown field. Grasses, rush and sedge grow in wet prairies.
- Fire and flooding squeeze out the plants and trees that don't belong in these areas.
- Drainage for agriculture is the main reason for marsh losses. The marshes that remain are mostly unsuitable for agriculture or are protected under wetland regulations.

CYPRESS SWAMPS

- These wetlands usually occur where slow-moving or still water is present most of the year.
- Cypress trees grow out of standing water.
- "Bald" cypress swamps form along rivers or lake margins; "Pond" cypress swamps appear mixed in with upland forests and prairies.
- The soils are flooded from four to eight months a year. The soil drains slowly.
- Fire helps keep other trees from establishing themselves here. After a fire, the cypress trees quickly grow back.
- Cypress swamps are protected under conservation laws.

HARDWOOD SWAMPS

- You'll often find these wetlands near lakes and rivers. Sometimes **hardwood** swamps overlap with cypress swamps.
- These are forested wetlands that feature mostly **deciduous** hardwood trees.
- Prolonged flooding of bordering rivers keep the forest floor submerged for part of the year. If this type of system is either drained or flooded for a long period of time, a new type of community will result. Therefore, this is a highly sensitive area.
- Trees consist largely of water tupelo, Carolina ash, and blackgum. You may also find red maple, sweetgum, and water hickory. Slightly more upland, you may find swamp chestnut oak.
- Bay swamps (also known as bayheads), are hardwood swamps where broad-leaf **evergreen** trees are the dominant plant species. The tallest trees may often be pines. These communities occur on level or gently sloping land or in depressed areas. Seepage water from upland areas keeps the bay swamps almost constantly wet.
- Hydric hammocks are upland, drier versions of hardwood swamps. These contain a mixture of broad-leafed evergreen and deciduous trees. Cabbage palmettos are often found here. Hydric hammocks are seldom flooded but have saturated soils much of the year.

For a list of many of District-owned wetlands that you may visit to see for yourself, refer to the *Recreational Guide to Southwest Florida Water Management District Lands*. Call (352) 796-7211 or 1-800-423-1476, extension 4757 to request a free copy.

Southwest Florida Water Management District

Protecting Our Water Resources

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Language Arts
Science
Social Science

Splash! Water resource education

Tight Squeeze

Endangered Species Game

Wetlands prevent flooding, replenish groundwater supplies and purify stormwater. Because of the benefits to our water resources that wetlands provide, we have ample reasons to protect them.

Wildlife depends on wetlands as well. Many of the state's most popular — and increasingly scarce — animals make their homes in Florida's various types of wetlands.

In this activity, your students will play a game that shows how a handful of Florida's most endangered species depend on wetland habitats. This game will also symbolically show how the choices we make may impact animals and their habitat.

Learning goals

- To learn how wetlands and endangered species are connected
- To learn symbolically how human choices can have impacts on natural resources

Subjects

- Language Arts
- Science
- Social Science

Materials

- Animal/Wetland cards
- *Splash!* "Florida's Most Endangered List" fact sheet
- *Splash!* "Wetland Connection" fact sheet

Sunshine State Standards

Language Arts: Reading, LA.A.1.3, LA.A.2.3. **Science:** Processes that Shape the Earth, SC.D.2.3; Processes of Life, SC.F.1.3; How Living Things Interact with Their Environment, SC.G.1.3; The Nature of Science, SC.H.1.3. **Social Studies:** People, Places and Environments, SS.B.2.3

Activity

1. Once the students have become familiar with the types of wetlands and endangered species found in the **Southwest Florida Water Management District** as presented in the accompanying *Splash!* fact sheets, turn them loose on this variation of The Memory Game.

2. On the cover page to this unit you will find 20 squares depicting endangered animals and 20 showing wetland habitats. By cutting out the squares, you will create a class set of game cards.

3. The object of the game for the individual is to collect as many matches of animals and wetlands as possible. The object for the group is to play without leaving any remaining non-matching cards — representing animals without habitat.

4. In groups of 3-5 students, have players place the cards face up on a desk or table. The player who goes first selects one animal card and one wetland card without looking at the backs. The player then turns the cards over to see if the animal and habitat match. If they don't, the cards are returned to the table, and the turn is passed to another player. If the cards do match, the player goes again, keeping all the matches made along the way.

5. The game is played until all the animals are matched to habitats. The player with the most matches wins. If, however, the group makes all the possible matches and still has leftover animal and wetland cards, then the group plays again — this time using what they learned in the first round to form a strategy to help them find an appropriate home for every endangered animal.

Discussion

1. What do you believe happens when there are too many animals and not enough suitable habitat? (Animals need to find new homes, or they won't survive.)

2. What are actions that government agencies such as the **Southwest Florida Water Management District** can take to keep endangered species in their appropriate habitats? (Government agencies can regulate human activities that take place in endangered species habitat and can buy and preserve lands important to species' survival.)

3. What are actions that individuals can take to help endangered species? (Avoiding activities that cause pollution or disrupt animal habitat are two ways people can help out endangered species.)

Background

West Indian manatees have reasonably good eyesight and communicate by making a variety of sounds. These sounds can best be described as squeaks, chirps, grunts and groans.

You can see **wood storks** fishing in shallow water alongside highways.

Old male **alligators** may grow to be 14 feet long and weigh up to 1,000 pounds during a lifespan of 30 years or more.

Perhaps the shyest of all North American bears, the **Florida black bear** is intelligent and secretive, often working hard to avoid human contact. Bears eat mostly berries, acorns, insects, palmetto hearts and an occasional armadillo.

Voted the state mammal by schoolchildren, the **Florida panther** does most of its hunting during the twilight times of sunrise and dusk.

Roseate spoonbills use their spatula-like bills to stir shallow water, sweeping their heads back and forth until encountering prey which they snap up and swallow.

Southern bald eagles soar over feeding areas and swoop down on prey, clutching it with one or both talons—all while not breaking the rhythm of their flight. They can also dive deeply into rivers and lakes to catch fish.

Dancing is the **Florida Sandhill crane's** most mysterious behavior. People have long believed that the dancing was a courtship display. Although mated cranes dance together vigorously, they do not seem to dance together much while courting. Also close observation has shown that dancing occurs throughout the year by cranes of all ages. The dancing consists of wing-dropping, bowing and dipping, stiff-legged vaulting, running, flapping and tossing. During tossing bouts, one bird will pick up stones, sticks or bits of vegetation and fling it over its back. Cranes will dance when a cool wind comes up on a hot summer afternoon or when a potential predator is spotted. Dancing catches on quickly and will spread through a flock.

Southwest Florida Water Management District

Protecting Your Water Resources

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Southern Bald Eagle

Depends primarily upon:
- freshwater marshes
- hardwood swamps
- cypress swamps

American Alligator

Depends primarily upon:
- freshwater marshes
- cypress swamps
- hardwood swamps

Wood Stork

Depends primarily upon:
- cypress swamps
- mangrove swamps
- freshwater marshes

Florida Sandhill Crane

Depends primarily upon:
- freshwater marshes

Roseate Spoonbill

Depends primarily upon:
- coastal marshes
- mangrove swamps

West Indian Manatee

Depends primarily upon:
- coastal marshes
- mangrove swamps

Florida Black Bear

Depends primarily upon:
- cypress swamps
- hardwood swamps

Southern Bald Eagle

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- hardwood swamps
- cypress swamps

Wood Stork

Depends primarily upon:
- cypress swamps
- mangrove swamps
- freshwater marshes

Mangrove Swamp

Provides habitat to:
- West Indian manatee
- roseate spoonbill
- wood stork

Cypress Swamp

Provides habitat to:
- Southern bald eagle
- wood stork
- Florida panther
- Florida black bear
- American alligator

Hardwood Swamp

Provides habitat to:
- southern bald eagle
- Florida black bear
- Florida panther
- American alligator

Freshwater Marsh

Provides habitat to:
- southern bald eagle
- sandhill crane
- wood stork
- Florida panther
- American alligator

Hardwood Swamp

Provides habitat to:
- southern bald eagle
- Florida black bear
- Florida panther
- American alligator

Coastal Marsh

Provides habitat to:
- West Indian manatee
- roseate spoonbill

Freshwater Marsh

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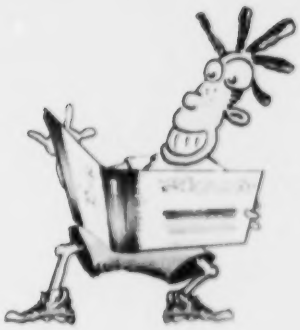
- Florida panther
- American alligator

Teacher's Evaluation Form

Please Return Evaluation To:
Public Communications Department • Southwest Florida Water Management District
2379 Broad Street • Brooksville, Florida 34609 or fax (352) 754-6883

Splash!
water resource education



To help us measure the educational effectiveness of *Splash!*, please take a few minutes to fill out the following evaluation.

As an incentive for filling out and returning this evaluation, we will send you your choice of a FREE copy of the water conservation book, *How to Get Water Smart*, OR a rain gauge – *while supplies last.*

1. **Listed below are the activities and additional features included in *Splash!***
   Please rate them according to their educational effectiveness.
   1 = least effective 4 = most effective (please circle on chart)

	least			most
Building a Wetland	1	2	3	4
Desal World	1	2	3	4
Desal World II	1	2	3	4
Hydro Cycle Works	1	2	3	4
Old Water Tales	1	2	3	4
Water by the Numbers	1	2	3	4
Water on the Web Fact Sheet	1	2	3	4
Water-Saving Tips Fact Sheet	1	2	3	4
Wa-ter Ya Eatin'?	1	2	3	4
Waterful, FL	1	2	3	4
Wetland for Your Thoughts Fact Sheet	1	2	3	4
Give Shape to a Xeriscape	1	2	3	4
Tight Squeeze	1	2	3	4
Wetland Connection Fact Sheet	1	2	3	4
Endangered Species Fact Sheet	1	2	3	4
Showerlock Holmes	1	2	3	4
Conservation Poster	1	2	3	4

more on back

2. **How have you used *Splash!* activities in your classroom?**
Check any that apply:
____ (a) to supplement my regular curriculum
____ (b) as an interdisciplinary tool in my classroom
____ (c) as a team project
____ (d) to connect water resource issues to real world scenarios
____ (e) other _____

3. **Please provide the following information:**
Number of students who participated in *Splash!* activities: _____
Grade Level(s) _____
Subject(s) _____
County _____

4. **What method(s) of assessment did you use in conjunction with these activities?**
Please explain: _____
_____
Please provide the average student learning increase (if any) obtained through the assessment. Please quantify this number as a percentage: _____

5. **Do you have any comments about specific activities or sections?**

6. **How useful was the inclusion of the Sunshine State Standards toward meeting your overall educational goals?**

7. **Additional comments or suggestions:**

8. **(Optional)**
Please send me (choose one only, *while supplies last*):
❒ *How to Get Water Smart* or ❒ Rain Gauge

Name: _____
School: _____
School Address: _____ County: _____
City: _____ State: _____ Zip: _____
Telephone: ( ) _____

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Southwest Florida Water Management District

Protecting Your Water Resources

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Splash
water resource education

Water Resource Education Free Materials Order Form

Classroom Materials Available to You
From the Southwest Florida Water Management District

Protecting *Your* Water Resources

Material Descriptions:

Who Gets the Water?
Grades 6-8. This interdisciplinary curriculum provides a basic understanding of the environmental and economic concepts students will need to make good decisions in the face of limited resources. Curriculum activities include making water cycles, practicing percentage and estimation skills with water bills, making decisions about a limited water supply, and many others. *Available through workshops only.*

Florida's Geology Unearthed
Grades 7-10. A video, teacher's guide and supplemental materials form the basis of this curriculum designed by the Florida Geological Survey. These materials help inform and stimulate students in a variety of topics related to earth science, natural resources, environments and ecosystems. *Available through workshops only.*

Water From the Ground Up
Grades 4-6. This full curriculum consists of text, teacher's guide, activity book and basic hydrologic information. Topics include surface water and groundwater sources in west central Florida, water quality, water use, floods, droughts and water conservation. *Available through workshops only.*

Water Watchers
Grades K-3. This curriculum package includes a teacher's guide and classic children's songs with water resource lyrics. It also features simple experiments to illustrate such concepts as the hydrologic cycle, water pollution, saltwater intrusion and others. *Available through workshops only.*

Florida Waters Project Teacher's Guide
Grades 6-8. **1996 Guide:** This curriculum encourages students to investigate and explore the water systems in their communities and to take an active role in the protection and preservation of our precious water resources. Activities and background information are included in the curriculum.
Grades 6-8. **1997 Guide:** The focus of this curriculum helps students to learn about the process of water management and their place in it. Several multidisciplinary activities focus on water issues and decision making.

Florida's Water Resource Activity Pack
Grades 2-5. A supplement to *The Schoolyard Wildlife Activity Guide,* these activities are specifically designed to include an outdoor component and range from the role of plants in the water cycle to sources of water pollution on school grounds.

Water Web
Grades 6-12. Each installment of the *Water Web* newsletter focuses on current water issues of local significance. Contents include civics, economics, science, vocational and math components, as well as a classroom activity. These periodicals serve as a resource for students and teachers. Five issues per year are available as classroom sets.

Tabloids
Grades 4-7. Produced in association with *The Tampa Tribune,* "Water Wise Citizen" focuses on water conservation, "Water Wise Habitats" features animals who live in wetlands, and "Water Wise Connections" teaches students about water quality. These learning resources are available as classroom sets and have accompanying teacher's guides.

Videos
General Public. Master copies of these water resource related videos are available free through your school board and may be duplicated or you can can order your own copies for $5 each.

Basin Maps
General Public. These poster-size color maps available for the basins within the Southwest Florida Water Management District will give your students a closer look at the water features, geography and natural resources in their area.

River Posters
General Public. These full-color photographic posters feature local river scenes and poems. Rivers depicted include the Withlacoochee, Manatee, Peace, Alafia, Hillsborough, and Myakka.

(see reverse side to order materials)

printed on recycled paper

Questions? In Florida: 1-800-423-1476, ext. 4757

Order Form *(see reverse for description of materials)*

Free Materials Contained in an Information Kit

QTY.	NAME OF ITEM
	Water Wise Citizen
	• Tabloids
	• Teacher's Guide
	Water Wise Connection
	• Tabloids
	• Teacher's Guide
	Water Wise Habitats
	• Tabloids
	• Teacher's Guide
	Water Wise Technology
	• Tabloids
	• Teacher's Guide

QTY.	NAME OF ITEM
	Water Web
	• Single Copies
	• Class sets (35)
	Hydroforce Coloring Book
	Grades K-2
	• Single Copies
	• Class Sets (35)
	Grades 3-5
	• Single Copies
	• Class Sets (35)

QTY.	NAME OF ITEM
	Other
	Florida's Water Resource Activity Pack *A supplement to The Schoolyard Wildlife Activity Guide*
	Wetlands Coloring Sheets
	Water Cycle Coloring Sheets
	Conservation Bookmarks
	Florida Waters Project
	• 1996 Teacher's Guide
	• 1997 Teacher's Guide
	Information Kit
	Containing a sample of all of the above

Free Materials Available for Water Resource Workshop Participants Only.

For information on how to participate in a SWFWMD Water Resource Workshop see the accompanying form or call in Florida 1-800-423-1476 extension 4757

QTY.	NAME OF ITEM
	Florida's Geology Unearthed
	Water From the Ground Up
	• Lesson Book
	• Activity Book

Please provide date and location of Water Resources Workshop you have attended.

Date: _____

Location: _____

Other Materials Available to You

QTY.	NAME OF ITEM
	"Save Water" Temporary Tattoos
	Class set (35)
	How to Get Water Smart
	Water Conservation Book
	Regular Videos ($5 each)
	Florida Lakes
	This Land Is Your Land
	Water Saved is Water Shared
	Water in the Public Interest
	Basin Videos ($5 each)
	Alafia River
	Coastal Rivers
	Hillsborough River
	North West Hillsborough

QTY.	NAME OF ITEM
	Peace River
	Pinellas-Anclote River
	Withlacoochee River
	Maps/Posters
	Alafia River Basin Map
	Coastal Rivers Basin Map
	Hillsborough River Basin Map
	Manasota Basin Map
	NW Hillsborough Basin Map
	Peace River Basin Map
	Pinellas-Anclote River Basin Map
	Withlacoochee River Basin Map
	Do Your Part Poster
	Alafia River Poster

QTY.	NAME OF ITEM
	Hillsborough River Poster
	Manatee River Poster
	Myakka River Poster
	Peace River Poster
	Withlacoochee River Poster
	Water Conservation Poster
	Hydrologic Cycle Poster
	SWFWMD Publications
	District Brochure
	50 Ways to Do Your Part
	Issues Papers
	Recreational Guide

Please send me the educational material listed above. To purchase videos, enclose check payable to SWFWMD.

Send to: (please print)

Name _____ School _____ Grade(s) _____

Address _____

City _____ State _____ County _____ Zip _____

Phone ( ) _____ Subject Area(s) _____

Southwest Florida Water Management District

Protecting Your Water Resources

Send completed form to:

In-School Education Program • Southwest Florida Water Management District • 2379 Broad Street • Brooksville, FL 34609

Phone: (352) 796-7211, extension 4757 • In Florida: 1-800-423-1476 • fax: (352) 754-6883

If a disabled individual wishes to obtain the information contained in this document in another form, please contact the Southwest Florida Water Management District's Public Communications Department at (352) 796-7211, extension 4757, or 1-800-423-1476, extension 4757 (Florida only), TDD only 1-800-231-6103 (Florida only), fax number (352) 754-6883.